Conceptual Playworld as a Method of Facilitating Learning Beyond Subject Matter in Elementary School

Anne-Line Bjerknes, Ingunn Skalstad & Sören Räpple-Freudenreich

ABSTRACT

Children experience less time to play due to the focus on learning in early childhood education and earlier school starting times. Paradoxically, play is important for children's learning and contributes to increased curiosity, wonder, and learning motivation. It is also important for children's sense of belonging in society, social relationships, as well as physical and mental quality of life. In Norway, a new curriculum demands that pupils learn about increased life quality through interdisciplinary teaching but also suggests that play should be included in teaching to promote creative and meaningful learning. Research shows that teachers often let pupils play, but they have little experience and knowledge of how play can both promote learning and secure the quality of life of their pupils. One teacher educator and six student teachers constructed a "Conceptual Playworld" for 18 pupils in 2nd grade. The certified teacher acted as observer together with another teacher educator. Through interviews, we investigated what those who taught and observed experienced and observed. The results show that "Conceptual Playworld" is a method that seems to promote a holistic approach to learning where the pupils acquire social skills in combination with subject knowledge.

Keywords: *holistic learning; play-based learning; natural science; elementary school; quality of life*

Anne-Line Bjerknes, University of South-Eastern Norway, e-mail: anne-line. bjerknes@usn.no

Ingunn Skalstad, University of South-Eastern Norway, e-mail: ingunn. skalstad@usn.no

Sören Räpple-Freudenreich, University of South-Eastern Norway, e-mail: soren. rapple@usn.no

Introduction

Internationally, children's free play areas are being reduced (Korkodilos, 2016) along with the opportunity for play because children are starting school earlier. In Norway, it was found that children's outdoor play is increasingly reduced due to organized

leisure time after school (Broch et al., 2022). At the same time, early childhood education (ECE) has also been given a more central role in the educational process. Thus, more of the play has been lost because ECE must be in accordance with management documents that focus on learning and not just play (Oberhuemer, 2005). However, research shows that through play, children develop cognitively, socially and emotionally, imaginatively, and physically (Brussoni et al., 2015; Frønes, 1997; Lillemyr, 2011; Russ et al., 1999; Ruud, 2010). This can be linked to holistic learning (Bae, 2018). According to Bae (2018), practicing a holistic approach to learning is characterized by learning taking place not only in planned activities that focus on academic learning, but in many different situations, such as everyday as well as in care and play situations (Bae, 2018). Other characteristics are that the children are actively participating subjects, and that they learn in multimodal processes. That is, the learning process involves many senses through experiences where mental, emotional, bodily, and sensory impressions work together. A holistic learning approach is also characterized by its focus on social learning and socializing, not primarily on cognitive skills (Bae, 2018). However, cognitive skills may also be an outcome of this process (Burdette et al., 2005).

The Convention on the Rights of the Child (CRC) is considered whenever a new curriculum is written for primary school in Norway. The CRC recognizes children's rights to rest, free time, and participation in play and leisure activities (United Nations, 1989). In the general part of the Norwegian curriculum for primary school (grades 1–10, ages 6–16) (Ministry of Education and Research, 2017, p. 7), it is written that "For the youngest children in school, play is necessary for well-being and development, but also in education as a whole, play provides opportunities for creative and meaningful learning." Hence, without using the term "holistic learning" in the curriculum, the focus on children's well-being, creativity, and development resembles a holistic learning approach. In Norwegian schools, play is a natural part during the breaks throughout the school day, but because of the curriculum, it is also expected that play should be integrated more when teaching subject matter (Eik, 2022, p. 34). To do this properly, a good place to start is to observe how this is done in ECE practice and didactics.

Worldwide, ECE actively uses play-based learning methods, where play and learning are intertwined in a playful way, whereas the use of play-based learning methods in school is more debated (Kuschner, 2012; Mardell et al., 2019). Play-based learning methods may differ greatly in how much they allow the children to self-initiate the learning process during the play (Pyle & Danniels, 2017), and how teachers believe they participate in play (Bjerknes & Skalstad, 2022). In this study, we introduced a play-based learning method called Playworld. Previous research on Playworld has mainly focused on building play narratives (Hakkarainen, 2010; Lindqvist, 1995). More recently, Playworld has been used in natural science education, called Scientific Playworld (Fleer, 2019), and when learning concepts, called Conceptual Playworld (CPW) (Fleer, 2021). In this study, the Playworld was introduced to a 2nd grade class at a Norwegian elementary school for learning natural science and scientific concepts.

We choose to use the abbreviations CPW further to highlight the focus on learning and not only a play narrative, as in Playworld. CPW forces teachers to actively play out a story from a book together with the pupils. The CPW model (Table 1) must present a problem that needs to be solved, and both children and teachers participate with roles in the play to solve the problem. When using CPW, teachers must (1) select a book/story they know the children like and that can be played out by finding play roles in the story, (2) design a space inside or outside where the play can occur, (3) decide how one shall enter and exit the play together with the pupils, (4) plan a play scenario/problem that needs to be solved, and (5) decide roles for teachers and pupils. The method also allows the children to participate as participating subjects where they can help the teacher to define roles and the development of the play.

The aim of this study is to investigate if CPW as a teaching approach can contribute to a holistic approach to learning in natural science in elementary school.

We ask the following research questions:

1) How do the teachers experience the learning process?
2) What do the teachers experience that the pupils learn in CPW?

Background

Play is usually defined as an activity that is initiated by a child without adult intervention (Samuelsson & Johansson, 2006), whereas learning is an activity that happens in the classroom with teacher involvement. However, the definition of learning itself is generally that it is a lasting change in behavior because of experience (Lunde & Brodal, 2022). We also know that triggering emotions, having a safe place, and social belonging are important when learning (Maslow, 1943; Pekrun, 2014).

The teacher's role in learning through play

In a school context, it is the role of the teachers and the extent to which they influence the play that are decisive for how the play is experienced by the pupils and what is learned. The teacher's presence in the play can be seen as a gradient, from fully teacher-directed to fully child-directed play (Pyle & Danniels, 2017). There are different opinions about the teacher's role during play. While some claim that adult presence can promote playful learning (Weisberg et al., 2016), in other contexts adults can inhibit playful learning (McInnes et al., 2013; Whitebread et al., 2007). However, guided play proves to be a good pedagogical tool for promoting academic learning (Reuter & Leuchter, 2021; Weisberg et al., 2016). Through guided play, children's autonomy is preserved, which is a central element in self-initiated play, while the teacher can contribute with specialist knowledge (Weisberg et al., 2016). However, it appears that teachers find it challenging to facilitate playful learning in ways that help achieve learning goals (Lillejord et al., 2018). In natural science, this

is commonly solved by introducing game-based learning methods, which refers to establishing learning environments that involve digital or non-digital games (with certain pre-defined rules) to enhance pupils' knowledge and skill acquisition (Wang & Zheng, 2021). The teachers usually assist the pupils, but do not participate in the games. Hence, this type of play does not allow playing out roles or using fantasy and imagination in the same manner as in a Playworld, where the pupils may define rules and roles themselves.

Intersubjectivity promotes learning

The quality of communication between teachers and pupils is important for children's learning (Samuelsson & Carlsson, 2008). The ability to interact and mutually focus on a particular content can be viewed as a fundamental aspect of teaching (Doverborg et al., 2013). However, research has found that shared attention is not enough for learning; the participants must also establish agreement in the dialogue. This agreement, referred to as intersubjectivity, is about sharing perspectives, experiences, and feelings, as well as being engaged in the same activity (Stern, 2007). This is central to developing pupils' interest, for example in science topics (Skalstad & Munkebye, 2022). Research carried out in ECE also shows that when a teacher assumes a role in play, it is often as an observer, stage worker, co-player, organizer, or co-organizer (Gaviria-Loaiza et al., 2017). According to Gaviria-Loaiza et al. (2017), children respond to these roles by rejecting, evaluating, or accepting them, and it is when the ECE teacher is involved in the play that the children respond acceptingly. The role of the co-playing teacher thus seems to support children's development and holistic approach to learning to a large extent. CPW is a type of guided play that allows pupils to explore and play freely, but also a method in which the teacher can encourage learning and promote intersubjectivity due to their own participation in the play.

Conceptual Playworld as a teaching method

Playworld is a form of guided play arising from ECE (Fleer, 2019; Hakkarainen et al., 2013; Lindqvist, 1995). This is a mode of play that promotes imagination, creativity, exploration and, at the same time, opens the possibility for the teacher to convey subject knowledge in a way that is adapted to the pupils' interests. Natural science includes many topics that pupils encounter in everyday life and in which they have a natural interest (e.g., Aslanian et al., 2023; Tunnicliffe & Gkouskou, 2020). For example, they play with throwing things into water and experiencing how certain materials sink or float. These experiences enhance pupils' understanding of concepts when learning about them later in school, such as mass density and surface membrane. Using concepts that children will need in play may enhance their learning and understanding of the topic taught. Hence, combining concepts and play in a play-based learning model such as CPW may promote a holistic approach to learning where both social development and conceptual learning co-occurs.

What appears to be unique for CPW is that it assigns an educational role to teachers in the play (Hakkarainen et al., 2013). The teacher actively supports children's imaginations, which, in turn, has been shown to develop their imaginative play (Lindqvist, 1995). The method is being increasingly used worldwide, but to our knowledge, only in ECE. However, similar methods, such as Storyline, are used in schools, but these methods do not strictly demand the teachers to participate as a co-player with the pupils. Furthermore, it is known that when scientific problems are introduced during children's play and teachers also act out scientific concepts together with children, this results in more authentic science learning (Fleer, 2011, 2015; Fleer & Pramling, 2015). Additionally, CPW was found to enable social-emotional literacy (Stephenson et al., 2021).

Method

The Conceptual Playworld approach

Six student teachers (STs) and their teacher educator (TE) set out to construct a CPW in a classroom with 18 pupils. They followed the CPW model (Table 1) for teaching science in play-based settings (Fleer, 2019). In this study, the CPW took place in different rooms in an imaginary hospital that was designed as a hospital. In Table 1, we show how these steps were played out in our study.

The STs/TE entered the hospital rooms together with the pupils, where they had roles as assistant doctors together with the pupils (who were patients and/or doctors). The STs/TE used scientific concepts during the play. After visiting all five hospital rooms, the pupils and STs/TE exited the CPW together.

Table 1. In the first two columns, the five steps of planning a Conceptual Playworld (CPW) are described (Fleer, 2019). In the last column, we show how the CPW was used in our study. Abbreviations: ST = student teacher, TE = teacher educator.

Steps	More about the steps	The steps in this study
1. Select a story/book. a. Identify the characters of the story. b. Find a drama in the story or a problem that should be solved. c. Select a topic you like so that you engage better.	Using literature will help you create an imaginary situation for the pupils. It can be themes within science, engineering, social and emotional relations, narratives, etc. But it should be complex so that you can revisit the story. Select a story that you believe the pupils will like but also that you as a teacher like, as you will take a role in the play.	In this context, prior to the teaching, the ST wrote a story for the play and decided on roles for the ST/TE. The story was read aloud to the pupils before the play started. The story took place in the pupils' village, where they heard that a hurricane had destroyed the hospital and the hospital would be moved to their school. The hospital needed assistance from the pupils to help injured patients.

Table 1. (*Continued*)

Steps	More about the steps	The steps in this study
2. Design the spaces for the Playworld inside or outside.	Design the Playworld to be either outside or inside. Assure that the pupils feel that they enter a setting other than what is normal to them.	The ST built five different rooms for the hospital: 1) The waiting room, where pupils read books and magazines about the body. The books were selected to be entertaining and at different levels for the pupils. Templates were filled out with name, birthdate, sex, hospitalization reason, previous blood test experience, and allergies. 2) The blood test room, where the pupils would take blood tests (red paint). Depending on the bacteria (glitter in different colors) found in their blood (seen in a microscope), they needed to calculate how many pills (raisins) they would need three times per day for a week. 3) The X-ray room. Beforehand, the teacher had printed out X-ray pictures on paper. The pupils had to analyze the (preprinted) X-ray pictures and write their own health reports, depending on the injury that was found. 4) The operation room that received patients (teddy bears) that had bathed in polluted water. The pupils operated on the patients. The student teachers had planted fake organs and fake blood within the teddy bears, giving the operation an authentic touch and making it feel genuine. Each patient was weighed to calculate how much anesthesia they needed and then operated on with a scalpel and tweezers. To authenticate the play, the pupils wore gloves, masks, and hairnets. 5) The therapy room with differentiated assignments where the pupils could color hospital logos for their hospital, make "get well cards," and write a story about how "once, I got ill and everything went well."

Steps	More about the steps	The steps in this study
3. Decide how you will enter and exit the Playworld.	The pupils will understand when they enter and exit the Playworld.	In this Playworld, the mayor called pupils to tell them that the school needed to be a hospital due to a hurricane that had caused a failure in the electricity lines to the city hospital. After a while, the mayor called to tell them that the electricity returned and the city hospital could reassume its responsibilities.
4. Planning the play scenario/problem: something to solve, model that expands the play.	By creating a scenario or problem in the story, the play will be expanded and the children will engage more in the topic.	The main scenarios, in this case, were different injuries to people that needed to be taken care of in a hospital, such as infections, poisoning, broken bones, and psychological problems, so pupils had to help injured patients physically and mentally.
5. Decide the roles for the teachers and pupils.		The ST, TE, and pupils were nurses and doctors. Pupils were also patients.

Participants

The CPW was part of a lecture plan in a teacher education program in Norway. The STs learned the CPW method in their studies and tested the method in a school class together with their TE. The class's certified teacher (CT) supported the STs and TE to test the CPW method in a real situation. Eighteen 2nd grade pupils (7–8 years old) experienced a CPW organized by six STs and one TE (the third author of the present study). The CT and another TE (the first author) observed the STs and TE in the CPW. Subsequently, three semi-structured interviews were performed with the TE, the CT, and two STs. The TE and the CT were interviewed separately because they had different roles and were asked different questions. The two STs were interviewed together. All six STs were asked to participate in a group interview. Two of the STs replied that they would like to participate.

Ethical considerations

To consider possible conflicts of interest, we chose to interview two STs (1 and 2) and their TE separately. As the TE should also assess the students in the education program. Beforehand, all four participants received an interview guide. Ethical approval was obtained via the Norwegian Centre for Research Data through a larger research project, *Bridging the gaps in teacher education and schools through interdisciplinary work* (BRIDGES). Prior to each interview, each participant signed an informed consent form. For the pupils, the parents signed this form. All

interviews were audiotaped, anonymized, transcribed, and saved in Services for Sensitive Data (TSD).

Data analysis

Semi-structured interviews

We used semi-structured interviews. All interviews were carried out in Zoom and lasted 60 minutes. Semi-structured interviews offer additional depth by inviting dialogic exchange to information supplied by questionnaires or fully structured interviews. By doing so, the researcher actively constructs knowledge in partnership with the respondent, who constructs answers to questions that may require them to consider issues in a depth not explicitly previously explored (Fontana & Frey, 2000).

The analytical process

All three audio recordings were transcribed verbatim and anonymized before analysis. Our analytical process in this study is inspired by Braun and Clarke's (2019) approach for reflexive thematic analysis. We analyzed in seven steps: (1) familiarization with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, (6) recursing and looking through previous steps assuring for coding reliability and transparency, and (7) producing the manuscript. Notably, this method of analysis is recursive, meaning that each subsequent step in the analysis might promote users to circle back to earlier steps considering newly emerged themes or data (Kiger & Varpio, 2020), and assures the coding reliability and transparency (Braun & Clarke, 2019).

Step 1: Familiarization with the data
First, we familiarized ourselves with the data by transcribing the interviews. Next, we examined and re-examined the transcripts and audiotapes of one of the three interviews together (steps 1–5). Subsequently, authors 1 and 2 did the same with the remaining two interviews, but separately, with one interview each. Authors 1 and 2 had ongoing dialogue during the coding process to discuss possible disagreements or doubts in the coding.

Steps 2 and 3: Generating initial codes and searching for themes
After reading and familiarizing ourselves with the dataset consisting of the three interviews, we divided the data material into smaller meaningful extracts related to the topic, the aim of the study, and the research questions. We wrote notes and comments on each of the extracts, and generated initial codes, based on extracts, which is step 2 in the analytical process. Examples of extracts and initial codes are presented in Table 2.

When the term "teacher" is applied in the tables, this refers to all, teacher educator (TE), student teachers (ST) and certified teacher (CT).

Table 2. Examples of extracts from data: the associated initial codes (step 2) and collated initial codes. Abbreviations: ST = student teacher, TE = teacher educator, CT = certified teacher

Examples of extracts	Step 2: Initial codes
A) Certified teacher (CT): And when they were going to calculate how much medicine they needed for a week, they weren't, "Yuck, numbers are boring." They were engaged because they needed it; it became more interesting for them. I'm sure of that.	• Calculating medicine for a week • Numbers are not boring • Engaged because they needed the knowledge • Learning became more interesting
B) Student teacher (ST): The children have gained an inner motivation. They wanted to do mathematics and writing. For example, to find out how many tablets...	• Children had an intrinsic motivation to learn • They wanted to do mathematics • They wanted to write Find out how many tablets they need
C) Certified teacher (CT): No one got bored. The children were busy and enjoying themselves. They didn't have the excess energy or frustration for negative things to happen. It's rare that I see the whole class work so well in a teaching lecture.	• No one got bored • The children were busy • The children enjoyed themselves • They didn't have excess energy • No frustration when negative things happened • The class worked well in a teaching lecture
D) Teacher educator (TE): Life skills are also about being taken seriously for who you are... To learn about the body and how it is built, but to learn about it in a playful way and do it through play on the premises of this young pupil is, in practice, a way to take their life expression seriously. To do this through the method, which is one of many methods one can use...	• Life skills • Take children seriously for who they are • Learn about the body and how it is built • Learn in a playful way • Take the pupil's life expression seriously • Learn on the pupil's premises

In step 3, we examined, sorted, and collated the initial codes to identify potential sub-themes in the data. The data extracts related to each sub-theme were also collated. Examples of collated initial codes and potential sub-themes developed in step 3 are presented in Table 3.

The initial coding has a partly deductive approach, as the main research questions constitute the main themes and are also theory driven. According to Braun and Clarke (2006), coding depends to a certain degree on whether the themes are data-driven or theory-driven. As the data in this study consist of the interviewees' answers to questions about specific topics, which in turn are based on the aim and research questions of the study, the sub-themes developed in this study can therefore be said to be theory-driven.

Table 3. Examples of potential themes derived from the collated initial codes (cf. the initial codes presented in Table 2). The letters in parentheses refer to the extracts from the data presented in Table 2.

Step 2		Step 3
Collated initial codes (Not an exhaustive list)	**Searching for potential themes**	**Potential main themes (MT) and sub-themes**

• Calculating medicine for a week (A)
• Numbers are not boring (A)
• They wanted to do the mathematics (B)
• Learn about the body and how it is built (D)
• They wanted to write (B)
• Find out how many tablets they need (B)
• Life skills (D)
• No frustration when negative things happened (C)
• The class worked well in a teaching lecture (C)
	• Knowledge
	• Skills
	• Academic learning
	• Learning mathematics
	• Counting
	• Learning natural science
	• Writing
	• Life skills
	• Interdisciplinary learning
	• Social learning
		• Knowledge and skills (MT)
		• Academic learning (MT)
		  ◦ Learning mathematics
		  ◦ Counting
		  ◦ Learning natural science
		  ◦ Writing
		• Interdisciplinary learning (MT)
		  ◦ Life skills
		• Social learning

• Numbers are not boring (A) • No one got bored (C) • Engaged because they needed the knowledge (A) • Find out how many tablets they need (B) • Learning became more interesting (A) • They wanted to do the mathematics (B) • They wanted to write (B) • The children were busy (C) • They didn't have excess energy • Take children seriously for who they are (D) • Learn on the pupil's premises (D) • Learn in a playful way (D)	• Learning is not boring • They need the knowledge • Learning is relevant • Engaging in the activity • Engaging in learning • Learning is interesting • Active children • Active learning • Learning on the pupil's premises	• Learning is engaging • Learning is relevant • Children are active • Learning on the children's premises

• Numbers are not boring (A)
• Children have gained an intrinsic motivation (B)
• The children enjoyed themselves (C)
• No frustration when negative things happened (C)
• Take the life expression seriously (D)
	• Learning is not boring
	• Intrinsic motivation to learn
	• Positive experience
	• Positive emotions
	• Sense of mastery
		• Emotions (MT)
		  ◦ Engaging
		  ◦ Positive emotions
		  ◦ Intrinsic motivation to learn
		  ◦ Sense of mastery

• No frustration when negative things happened (C) • The class worked well in a teaching lecture (C)	• Positive interactions between the pupils • Good relationships	• Promoting good pupil–pupil relationships

Steps 4, 5 and 6: Reviewing, defining, and naming themes

In step 4, the collated potential sub-themes generated in step 3 were reviewed to identify potential patterns in the data. As a result, potential sub-themes from step 3 (cf. Table 3) were grouped into sub-themes. A list of all reviewed themes generated in step 4 and the final themes generated in step 5 are presented in Table 4.

Table 4. Overview of all the refined and final themes and sub-themes developed in steps 4 and 5, respectively.

Step 4	Step 5
Refined themes (complete list)	**Final themes** (complete list)
Main theme (MT) and sub-themes	Main theme (MT) and sub-themes
Knowledge and skills (MT)	What the pupils learn (MT)
○ Academic learning	○ Academic learning
○ Interdisciplinary learning	○ Interdisciplinary learning
○ Social learning	○ Social learning
○ Practical learning	○ Practical learning
The learning process (MT)	Pupils' learning process (MT)
○ Active learning	○ Active learning
○ Authentic learning	○ Authentic learning
○ Relevant	○ Learning is relevant
○ Aesthetic learning process	○ Aesthetic learning
○ Learning through sensory experience	○ Learning through sensory experiences
Emotions and experiences (MT)	How the pupils experience the learning process (MT)
○ Fun	○ Positive emotions
○ Positive emotions	○ Engaging
○ Engaging	○ Sense of mastery
○ Sense of mastery	○ Motivation to learn
○ Motivation to learn	
Relationships (MT)	Promoting good relationships (MT)
○ Promoting good pupil–pupil relationships	○ Good relationships between pupils
○ Promoting good pupil–teacher relationships	○ Good relationships between pupils and teachers

Results

Here, we present results on how the teachers (TE, ST (1 and 2) and CT) experienced the characteristics of the learning processes, and their experiences of what the pupils' learned during the CPW. We also present challenges with applying CPW in the classroom.

What characterizes the learning processes appearing in the CPW?

Active, authentic, and relevant learning

According to the interviewees, pupils learned through a "real-life" situation where they participated actively and experienced the learning process as relevant and

authentic. This applies to both learning practical skills as well as academic concepts and strategies. For example, the CT observed about a usually quiet girl in the class: "This girl has talked a lot about becoming a nurse or a doctor at home […] getting the chance to do surgery on a teddy bear hit the spot."

One of the STs (1) also expressed the need for teaching elementary school by bringing authentic experience and learning to the classroom: "This is very close to real experience. We must teach from pupils' experience. If you don't have experience in hospitals or have thought about how your body works," indicating that CPW contributes to pupils' authentic experiences.

The interviewees pointed out that academic terms and mathematical strategies were applied by the pupils because they needed to use them. One of the STs (1) said: "and when they had to calculate what they needed for medicine for a week, they weren't, 'Well, numbers are boring.' They themselves were engaged because they needed it; it became more interesting for them. I'm absolutely sure."

Learning through sensory experiences

All interviewees saw that the pupils used their senses during the learning process. One ST said: "they were allowed to use their senses and bodies." The CT also mentioned the quiet girl that enjoyed carrying out a surgery on the teddy bear and using medical tools: "The practical work and sensory experiences hit the spot for this girl." At the same time, the CT also mentioned how important such learning processes are for the pupils to remember what they are learning: "Children remember much more when learning through experience than by watching a film or reading a paper." This is in line with holistic learning, where many senses are involved in the learning process.

Positive emotions and engagement

All teachers emphasized that the use of CPW created engagement among the pupils. One of the STs said that the CPW is an "informative and very nice way to teach. The advantages are that the children experience academic content in a different way— they do not become recipients. They produce. They play a role. They are internally motivated and engaged." The TE said:

> I saw the effect of this concept on the children. We went on for three hours WITHOUT a break. No one asked for a break or when we would be done; quite the contrary. "We want to do this more!" I learned that in practice there: this is something children are so ready for. It is roleplay, fantasy play, seasoned with some academic issues related to arithmetic and writing, which children are very good at. I experienced that it created a tremendous commitment. (TE)

Sense of mastery and motivation to learn

The CPW invites the pupils to differentiate in a way that does not put them in the shadow of better-achieving pupils, and both the STs and CT observed self-efficacy bloom in the pupils. The pupils' belief in their ability to manage something new was visible in many ways. One ST noted:

> I think it gives them more coping skills. That they want to explore further that they become more curious, more confident, more confident that they can get things done. There is no culture of comparison because it is not so clear what the others achieve and what you achieve – everyone got a pill box, and everyone got to try the MRI machine. Everyone got blood taken. Everyone made cards—although some may have drawn more than they wrote—but everyone had an opinion on what they got down on the card. Some pupils read one book, while others read another book; it's not like everyone should read the same book. […] It is not natural to compare yourself in this situation. (ST1)

That pupils wanted to explore, were allowed to explore, and chose how to solve the different problems shows that this learning environment was experienced as a safe place to learn and that they even did things that could surprise the CT:

> Especially one pupil, who takes a long time to become confident or try new things, but then I saw a girl that I had never seen before. While the others said, "Ugh, so disgusting," this girl was concentrating so hard. And she has spoken very positively about this play experience at home, that it was fun. (CT)

When pupils play in a CPW, they also experience a need to use the right concepts during the play. As one ST noted:

> I think that the children have a learning need. If you use the CPW […] then the children may have a desire to learn more about something […] it creates a need for learning. As in natural science, we talk a lot about not just serving the students the concepts—they should have a need to learn them before we come up with them. And a CPW like this is good for promoting this need. (ST1)

What the teachers experience as pupils' learning

The analysis of the interviews showed that all interviewees pointed at CPW as a method in which the pupils, in addition to learning social skills, acquired knowledge both practically and academically in several different subjects and in interdisciplinary topics such as public health, life skills, democracy, and citizenship. The Norwegian Ministry of Education and Research (2017) states that health and life

skills shall give the pupils competence which promotes physical and mental health, which provides opportunities for making responsible life choices. In childhood and adolescent years, the development of a positive self-image and confident identity is particularly important.

Social learning

All interviewees highlighted the good relations between the pupils during the CPW activity. The CT, who knew the class well, said: "I have seldom seen the whole group work so well in a teaching process." This was confirmed by the TE: "I saw that the children in the group played well together. There weren't conflicts that day […] they settled into it." This implies that the pupils trained their social skills during the CPW activity.

Good relationships between pupils

Our results also showed that applying CPW promotes positive interactions between pupils. The CT recognized that there was no quarreling and that pupils that normally did not talk to each other did so during the CPW activity.

Both, the CT and TE highlighted the positive interactions between the pupils during the CPW. The CT mentions the positive interaction between the pupils several times – for example, when she says:

> The class is usually a rather demanding class. But that day there were NO conflicts […]. They didn't have the excess energy or frustration for negative things to happen. It's rare that I see the whole class work so well in a teaching lecture. (CT)

Good relationships between pupils and teachers

During the CPW, the STs and TE participated in the play together with the pupils. The CT and TSs experienced an improved relationship between the TE/STs and the pupils during the CPW activity. The CT pointed out that when both the pupils and the teacher are having fun, this also positively affects the relationship between the pupils and teacher:

> It is extremely important [that the teacher joins and plays]. The children think it's absolutely fantastic when adults join in the play […] One is equal, on the same level. It is important for children. The kids notice adults having fun and the kids think it's fun. Laugh and be horrified together […] They think it's great fun for a long time afterwards. Then I think that you will gain the children's trust as well […] The kids loved it, when the clowns came. There was a lot of humor, joy, and warmth between everyone. (CT)

Practical skills

The pupils practiced writing and reading Norwegian as well as central skills related to arts and crafts. One ST mentions that skills related to arts and crafts were applied when pupils were sewing up the teddy bear during surgery and when they were drawing Get Well Soon Cards for the "patients." When the pupils sewed the teddy bears and applied medical tools, such as stethoscopes or scalpels, they also practiced their practical skills. The pupils also experienced how various tools and instruments are functioning, such as scalpels, stethoscopes, and X-ray machines.

Academic learning

According to the STs, the CT, and the TE, the pupils learned subject matter in the form of various terms related to natural science topics and mathematics, and they applied various strategies when counting. One ST said: "It was fun […] to see all the different counting strategies the pupils applied to find the right amount of medicine they needed." The use of mathematical strategies was confirmed by the CT (see Table 2).

Interdisciplinary learning

The results show that by participating in a CPW built as a hospital, the children learned and experienced how a hospital is structured, which occupational groups work in a hospital, their working tasks, and what it is like to be a patient. Our results also show that the interviewees emphasized the knowledge and experience the pupils gained by acting in different tasks and roles in the hospital and by cooperating to solve various tasks in interdisciplinary subjects. One ST said: "Everyone has the right to be a doctor; everyone can be a patient. It's part of democracy. It is equality, and they are worth just as much in relation to democracy." Another ST noted: "This arrangement can present interdisciplinary topics very well. You have it all. You have democracy, you have lifestyle, you have sustainable development in terms of how you build the hospital – for example, by using recycled cardboard and fabrics."

The TE highlighted that applying CPW as a method can itself be related to life skills since "life skills are also about being taken seriously for who you are and learning about it in a playful way. Playful learning is on the young pupils' terms."

Challenges with applying CPW as a method in school

The teachers point out some challenges related to the use of CPW as a method. These challenges are linked to resources in terms of time and the number of teachers available, and the size of the classroom. Other challenges are related to the teachers' own perspective on the use of CPW as a method, and if the teacher can handle chaos and spontaneous situations that arise during the play.

Time and number of present teachers as limiting factors

All the teachers mention *time* as a limiting factor when planning and implementing CPW in teaching. This includes time for planning, preparation (creating and finding props), and time to carry out the CPW itself. The TE said: "It's a more time-consuming framework to conduct such teaching." One ST points out that more time provides more opportunities for ideas, participation, and more imagination:

> Over time, the play evolves, different pupils come up with ideas. Maybe, "Hey, this hospital is missing a café, we need to create a café" […] it was a short time, we never got to that part, and then it would have been much more playful, and more room for imagination, and the pupils would have come up with new ideas. Then, of course, they would have made the café if they wanted to. Since we had a short time, we didn't manage that. (ST1)

Both CT and ST point out that a lack of assistants or teachers is a challenge when using CPW. At the same time, the teachers suggest various ways this can be solved. For example, simplifying the Playworld without large and numerous props. The Playworld can be planned by multiple teachers together and can be used by multiple classes. The CT says:

> I could have modeled beforehand, and some of the activities could have been more self-directed. There are always two adults in the classroom. I wouldn't have done it alone. We could swap loan people so that one could carry it out. So, it could definitely have been possible. (CT)

The TE also mentions that the size of the classroom can be a limiting factor. At the same time, he points out ways to solve such a challenge. He says that:

> Depending on how your classroom is and how much extra space you have… I do think that one challenge is if you have a Playworld in the classroom, and the room is small with many pupils. However, a Playworld doesn't necessarily have to be indoors; a Playworld can also be outdoors. That's what I want to emphasize. We can also play that we are lumberjacks, forest owners, or Vikings who are going to build a Viking ship, and we need to figure out which trees are here and which ones we can use. It's actually a didactic concept that isn't confined to a classroom. (TE)

Teachers' attitudes

In the interviews, it is evident that it's important for the teacher to personally believe in the method's usefulness. The CT states: "One must believe in it [the method] yourself that it's useful. Otherwise, maybe you not put in that extra effort." Furthermore,

it's revealed that the teacher must tolerate chaos and be able to handle spontaneous situations that arise. For example, the CT says: "One must tolerate chaos […] not everyone can do that. One must expect kids to be all over the place. It's easier by the desk." One ST points out:

> I've learned that when creating a Playworld, you must be flexible and able to come up with something right away. It can suddenly take less time than planned, and other times it takes longer. You must have something "in your bag." (ST2)

Discussion

The aim of this case study was to see if applying CPW as a teaching approach can contribute to a holistic approach to learning in natural science in elementary school. Our results show that the teachers experienced that CPW promoted holistic learning through learning processes because they were active, authentic, relevant, using sensory experiences which emerged in positive emotions and engagement, and motivation to learn in the pupils. The teachers saw social, practical, and academic learning. In the following section, we discuss how applying CPW as a teaching approach in science, where teachers must take an active role as a co-player, may contribute to holistic learning in elementary school. We also discuss how children taking an active part in their own learning processes through play may trigger positive emotions during the learning process and may affect pupils' learning and well-being.

Holistic learning – stimulating all aspects of the pupils

When engaging in the CPW in school, the teachers observed that pupils engaged socially and that their minds were stimulated cognitively. The CPW facilitated different learning processes in the pupils, such as active participation in their own learning, authentic play, and sensory play. Through the learning processes they learned social and practical skills, as they acquired new academic knowledge when solving various problems. The pupils engaged their bodies actively and used their senses when they took part in practical tasks. The teachers observed expressions of positive emotions, well-being, and engagement during the activity, and that that the experience seemed to be meaningful and relevant for the pupils. The pupils used their creativity, as tasks could be solved in various ways, and they used their imagination, as they were encouraged to assume various roles and relate the activities to real life. This supports Bae's theory (2018) of how a holistic approach is characterized. How the academic terms and content are applied in a playful context where the pupils experience that they need the knowledge, contribute to a meaningful learning process; the pupils' minds, bodies, and spirits were brought together, which is an ideal outcome of learning through a holistic process (Mahmoudi et al., 2012).

Emotions and positive relations

Together with the abscence of conflicts on that day and the presence of social interactions, the pupils seemed to experience the classroom as a safe place. The CT observed two pupils that previously had never spoken to each other suddenly together reading and communicating about a book, and several children had commented that they wanted to do this more often during schooltime. These observations can be interpreted as showing that the classroom was a safe place to be. It was safe because there was no right or wrong, and the children could make many decisions themselves. They could participate in different roles. It was a teaching method that taught the children on their level of communication and not the other way around. An important aspect of CPW is that the teacher is an active co-player (Fleer, 2019). By participating in the play, the teacher can promote intersubjectivity (Stern, 2007), and thus also enhance motivation for learning and learning through communication (Samuelsson & Carlsson, 2008). Although teachers can inhibit playful learning when participating in play (McInnes et al., 2013; Whitebread et al., 2007), the context is relevant. There are studies that show teachers can make children feel outside in play when teachers participate (Greve et al., 2023). In this study, all children had to participate in the CPW as part of the teaching. In this case, the high presence of STs may have helped to secure the inclusion of all children, and we see this can be more challenging when teaching a class alone. The CT's observations of several pupils that wanted to play more and the girl that talked about the experiences with her parents, may indicate that pupils felt entertained and not bored. Pupils can get bored when they do not experience mastery in a learning process (Lunde & Brodal, 2022). The combination of how CPW induced play, fantasy, positive emotions in the pupils and good relations among all participants, also through intersubjectivity, promoted a holistic learning approach.

Conceptual Playworld induces multimodal learning processes

In this study, the STs and TE actively participated, as co-players, in the CPW together with the pupils. This contributed to more equal relationships between teachers and the pupils, and even to changing roles, as the pupils took the leading roles in some of the activities rather than the teachers. Being equal partners promotes dialogue and promotes learning opportunities in natural science (Munkebye, 2012; Sylva et al., 2004). The CT also pointed out that, by being a co-player, the teacher comes to see each pupil better, and positive emotions are induced in both pupils and teachers. This is in line with creating intersubjectivity (Stern, 2007), which is central for learning and developing interest in natural science topics (Doverborg et al., 2013; Siraj-Blatchford & Sylva, 2004; Skalstad & Munkebye, 2022; Sylva et al., 2004). However, again we must remind ourselves that in this study the pupils experienced the presence of seven teachers (very high teacher-pupil ratio) which makes it easier for the pupil to be seen by a teacher.

Positive relationships between pupils and between pupils and teachers are central for achieving a good learning environment (Frenzel et al., 2009; Goetz et al., 2007). The results in this study clearly show that participating in CPW contributes to positive relations between pupils as well as between pupils and teachers. Both the CT and STs emphasized that CPW allows tasks to be solved in diverse ways and that the pupils get to use other sides of themselves than in regular classroom teaching. This indicates that there is a basis for differentiated teaching using CPW.

The findings in this study thus show that CPW may contribute to good learning conditions and that the teacher's role as a co-player is important in that respect. This is in line with Gaviria-Loaiza et al., (2017), who found that when teachers successfully participate as co-players in the play, the children respond acceptingly. A reason for this might be that the communication between the participants is characterized by intersubjectivity around a common topic played out in the CPW.

Promoting learning

If a pupil is to pay attention to a task, the task must be perceived as meaningful. What is experienced as meaningful is closely linked to what the child's current "project" is. This can be controlled to a limited extent by teachers (Lunde & Brodal, 2022). In this study, the teachers used many scientific concepts in the play, for example blood tests, medicine, and X-rays. Many of these words had to be understood by the pupils to communicate and take part in the roles of doctor or patient. Hence, the need to learn different concepts, in which context and how to use them, and the need to calculate the exact number of pills to fill in their jars may promote meaningful learning situations as they may be experienced as authentic and relevant. Studies performed in ECE show similar results (Fleer, 2019, 2021).

Limitations

There are some limitations related to this case study. Planning and performing Playworld as described in this study demand resources in terms of both time and teachers available. It is, however, not necessary to make it as comprehensive as in this study, which is also pointed out by the teachers in this study. With good imagination, one can pretend and imagine how it looks like, but the use of certain props such as gloves, fake blood and organs will help make the play feel more authentic. The most important part is that the teacher participates as a co-player. Importantly, this is a case study. Any conclusion on how and what children learn cannot be drawn based on one case study. However, based on previous studies from ECE, we know children participating in Playworld experience holistic and conceptual learning (Fleer, 2018, Fragkiadaki et al., 2021). Thus, we believe that more studies where teachers introduce play and play together with the children may be of great value also for education research for children in elementary school. Our results cannot be generalized.

The children experienced high teacher presence due to seven teachers and it was a new situation, which both may be experienced positively the first time. However, our results may help to draw attention towards more research on play-based learning where teachers actively take part in the play, together with the pupils, and where pupils may contribute more to how the play develops.

Conclusion

Playworld, also CPW, is used as a play-based learning method in ECE (e.g., Fleer, 2011, 2019, 2021; Hakkarainen et al., 2013). The results in this case study show that applying CPW as a teaching method may contribute to a holistic approach to learning in natural science in elementary school.

Having enough time is essential when planning to use a CPW in school. It is also important that the teacher has faith in the method. In this study the teachers designed two classrooms into five different hospital rooms. This costs time and resources, however, CPW can also be played out in a complete fantasy world.

In this case study, the teacher-pupil ratio was 7:18, which is extremely high, and uncommon for a regular school day. The observed attention each pupil received in this study may be more challenging to gain when working as a single teacher. On the other hand, it may be that the pupils experience the attention from the teacher in a different way when (s)he participates in the play as a co-player.

In Norway, teachers seem to know little about how they can use play-based learning when teaching natural science (Bjerknes & Skalstad, 2022). Our research adds to the limited knowledge on how CPW can be used as a teaching method in school and shows that applying CPW can contribute to a holistic approach to learning in natural science in elementary school. Due to the limitations in this study, such as too high teacher-pupil ratio, many props used to resemble a hospital, only one school class, and only interviews with the teachers, we the urge for more studies done on CPW in elementary school. To resemble more authentic school situations, we recommend studies to be done with a more realistic teacher-pupil ratio and fewer props.

Abbreviations: ECE = early childhood education, CPW = conceptual play world, ST = student teacher, TE = teacher educator, CT = certified teacher

Author biography

Anne-Line Bjerknes, PhD, associate professor within nature science, recent research interest: STEM, learning through curiosity, play and conversations, inter-disciplinary teaching (BRIDGES project), collaborative learning with early childhood education practical field (REKOMP), https://www.usn.no/kontakt-oss/tilsette/anne-line-bjerknes-1

Ingunn Skalstad, PhD, associate professor within nature science didactics, recent research interest: STEM, learning through curiosity, play and conversations, collaborative learning with early childhood education practical field (REKOMP), https://www.usn.no/kontakt-oss/tilsette/ingunn-skalstad

Sören Räpple-Freudenreich, assistant professor, within nature science didactics, recent research interest: learning through play, garden based education, outdoor education, environmental education, collaborative learning with early childhood education practical field (REKOMP), https://www.usn.no/kontakt-oss/tilsette/soren-rapple

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