https://doi.org/10.7577/formakademisk.2648

Ann-Hege Lorvik Waterhouse, Lovise Søyland and Kari Carlsen

Experimental explorations of materials and materiality in transmaterial landscapes

Summary
This article is based on an arts and crafts educational project in Norwegian early childhood teacher education. Through an a/r/tographic approach, we examine what happens when we open up to experimental, rhizomatic and unforeseen processes that transform physical and digital materials and phenomena into creative processes. The 2017 Norwegian Framework Plan for Kindergartens requires a renewed digital practice in early childhood education and early childhood teacher education. Through combinations of material and digital transformations, new material expressions and possibilities for action in creative processes arise. This article also demonstrates how shared knowledge can accumulate through creative processes in a collective learning environment, based on a rhizomatic understanding of such processes.

Keywords: a/r/tography, experimental processes**,** embodied, rhizomatic, transmateriality, digital practice

Introduction

The empirical study in this article invites you into an arts and crafts educational project with authors and students of early childhood teacher education (ECTE) at the University of South-Eastern Norway (USN). Like the rest of society, early childhood education (ECE) is characterized by rapid technological development. The Norwegian Framework Plan for Kindergartens (Ministry of Education and Research [MER], 2017, pp. 16-17) lays out clear guidelines for digital practice in ECE and gives teachers room for interpretation and action to shape this practice. It requires ECE teachers to acquire new knowledge and understanding of digital potential.

This article focuses on the experience of establishing connections between material-based experimental and creative processes and digital practice in ECE. We focus on explorative processes through various empirical excerpts and theoretical and methodological approaches. We highlight the educational tradition in ECE and strengthen the students' explorative and creative processes in order to increase their digital practice. ECE in Norway is for preschool-age children. Most children in Norway attend ECE from one to six years of age, though this is not mandatory. The tradition of arts and crafts education in Norwegian ECE and ECTE is based on an understanding that acknowledges children's direct experiences with materials and tools as fundamental to their learning (Dewey, 1934/2005). Children explore materials with their whole bodies and relate to the world through their senses (Carlsen, 2015; Eisner, 2002; Fredriksen, 2011, 2013; Waterhouse, 2013). Thelen (2000) underscores that children's physical actions in their environment contribute to shaping their minds. All learning is embodied, grounded in bodily interactions with the environment (Bengtsson, 2013; Gulliksen, 2017; Moser, 2014). Given the emphasis of the tradition of arts and crafts education on children's embodied and affective actions with physical two- and three-dimensional materials, it is worrying that this practice appears to be less firmly rooted in today's ECE than just a few years ago (Carlsen, 2015; Østrem et al., 2009).

We address the challenge implied in the focus of the Norwegian Framework Plan for Kindergartens on digital practice vis-à-vis its emphasis on the importance of embodied learning with physical materials. In the educational project, we challenge ECTE students to explore and create in a material and digital environment. New connections between the physically present and digitally becoming (Deleuze & Guattari, 1987) are incorporated into their knowledge base and are responsible for children's play and learning in ECE. This is what Haraway (2012) defines as "a praxis of care and response – response-ability" (p. 302), an ethical practice that deals with responsibility, action, and response and weaves together materialities and languages in "worldly practices" (Haraway, 1999, p. 109). Barad (2012) follows this thinking around response-ability by adding that it is not about the correct response "but rather a matter of inviting, welcoming, and enabling the response of the Other" (p. 81). Our interwoven educational and research project is about ethical and creative collective practices where the explorative and creative are intertwined into learning processes.

"Becoming" describes something in progress and in movement, a driving force that makes something happen. According to Deleuze and Guattari (1987), becoming cannot be understood as linear, something with a starting and end point; rather, it ought to be understood as something in-between, something that encloses and waves between and through and back and forth. We are entangled in becomings through our explorative creative processes with various materials and materialities. This requires, as we understand it, an openness to what can happen, what can arise in the in-between and in the unforeseen.

Digital technologies are integrated into the educational project as both a tool and a medium. Students and teachers (authors) work experimentally, creatively and exploratively with physical materials, touch devices, light, projectors, smartphones and lenses (macro, wide-angled and fish-eye) that can be used on touch devices and smartphones.

The article answers the following research question: What happens when we open up to experimental and unforeseen processes that transform physical and digital materials and phenomena into creative processes? We illustrate various aspects of this issue through empirical excerpts from the educational project, which can be understood as events, discoveries or small narratives (Waterhouse, 2016). Furthermore, we discuss interactions between students, teachers, materials and tools, arguing for a new, creative, material–digital practice in ECE, where different forms of expression are included in what we describe as "transmaterial" (Munster, 2014) landscapes.

New framework plan, new perspectives

Several studies highlight that the visual and performing arts in ECE are now receiving less attention than before (Bamford, 2012; Carlsen, 2015; Halland & Vist, 2016; Østrem et al., 2009). According to a report from "Følgjegruppa for barnehagelærerutdanninga" (2016) (a study of Norwegian ECTE), this tendency has also been recognized in ECTE. This shifting focus indicates a changed view about what the professional and educational content of ECE should be, with increased pressure on pre-defined learning outcomes (Carlsen, 2015; Otterstad, 2016). Despite the 2017 Framework Plan's emphasis on the exploratory and creative use of digital tools, research shows that there is relatively little exploratory use of digital technology in creative activities in ECE (Bølgan, 2009; Letnes, 2014). This is supported by *Barnehagemonitor 2015 – den digitale tilstanden i barnehagen* (a mapping survey about the digital condition of Norwegian ECE), conducted by the Norwegian Centre for ICT in Education (Jacobsen, Kofoed, & Loi, 2015). According to the survey, there is a general increase in children's use of digital tools, especially as it relates to listening to music, taking pictures and playing games. The study concludes that children appear to be primarily engaged in activities of a consuming nature and less in activities that leave room for creativity. Therefore, there is a need for a renewed digital practice in ECE, with obvious consequences for ECTE. The arts and crafts profession has a particular responsibility for visual competence throughout the educational process, from ECE to higher education. A renewed digital practice must both actively relate to visual expression and include spatial, creative activities that work with digital expressions.

The Framework Plan provides guidelines for digital practice in ECE. The most obvious change from the previous Framework Plan (MER, 2011) is the formulation from *should* to *shall* (MER, 2017) in descriptions of the use of digital tools and forms of expression by children and staff: "The staff must facilitate that children explore, play, learn and create through digital forms of expression", and "the staff shall explore creative use of digital tools together with children" (pp. 16-17). This requires that ECE teachers develop knowledge of digital tools and expressions, both for facilitating creative processes and through explorative and creative processes together with children. The Framework Plan points to the development of a renewed digital practice in collective processes. Under the subject area "Arts, Culture and Creativity", it specifies that ECE shall help children "explore a variety of artistic and cultural expressions" and "use different techniques, materials, tools, and technology to express themselves aesthetically" (p. 51). Finally, ECE "shall help children to have access to things, rooms, and materials that support their playful and aesthetic modes of expression" (p. 19). This underpins the experimental and exploratory aspects found in children's play and aesthetic expression. A change from *should* to *shall* ought to be seen as a consequence of previous discussions about shifting the positioning of children from consumers to producers in digital contexts (Haug & Jamissen, 2015; Letnes, 2014; Waterhouse, 2013).

Early childhood education: new perspectives and new practices

ECE staff shall facilitate children's exploration as well as explore together with children in creative ways. The educational project that forms the basis of this article was carried out in the ECTE course "Material og digital utforsking i formingsprosesser" [Material and digital exploration in creative processes], run in the Department of Visual and Performing Arts Education at the University of Southeast Norway (USN). The course provides a specialization in arts and crafts education and creative processes through different materials, techniques, tools and digital technologies. While the research project has not been finalized, it is entering new phases for each student cohort. The aims are to develop research-based teaching and work with teaching-based research in the context of our own practice as teachers in interaction with our students and, in later phases, with children and staff in ECE. The students' pedagogic and didactic knowledge is linked to their physical experiences. The theoretical framework described below supports this view and points to understandings of materialities, technologies, relations, bodies and knowledge and the experimental and unforeseen in creative processes.

Theoretical framework

Anthropologist Tim Ingold (2007) states that "like all other creatures, human beings do not exist on the 'other side' of materiality but swim in an ocean of materials" (p. 7). The world consists of matter. Matter is part of creative processes as a property of materials. There is increasing scientific evidence supporting that cognition in learning processes is grounded in and shaped by the physical body's experience and interaction in an environment (Bengtsson, 2013; Moser, 2014; Thelen, 2000). We assume that learning is embodied, rooted in bodily interaction and that senses, perception and experience are part of our cognition. This view of learning substantiates the need to participate in explorative processes with materials and tools: "In order to understand cognitive processes we must understand them as features of the whole body (including the brain) and its relation with the environment (i.e., the body embedded in a given environment, the body using different tools in a given environment)" (Raja, Biener, & Chemero, 2017, p. 147). The body as an integrated part of a given environment, in close relation to materials and tools, is a prerequisite for learning.

Psychologist James J. Gibson (1979) introduced the concept of affordance to describe living organisms' relation with the environment and what the environment offers. "An organism interacts with its surroundings by linking the perception of the environment's affordances to action, and cognition or learning is directly linked to the affordances that the environment offers" (Carlsen, 2015, p. 132). It is essential for learning related to materials and technology in creative processes to discover what affordances (Waterhouse, 2013, p. 32) and expressions can be produced by materials

and technologies. This process is about meaningful connections that can materialize in artistic expression.

Our knowledge depends on the context in which it is developed: It is situated (Haraway, 1988). Knowledge is developed in a context or situation, in a specific time and place. If the same materials and things appear in a different context, the learning processes will be different (Waterhouse, 2013). The room is part of the context, filled with limitations and possibilities; within Reggio-Emilia's educational philosophy, it is defined as a third educator, a partner in learning processes (Carlsen, 2015): "The language of the room is very strong and a conditioning factor. Although the code is not always explicit and recognizable, we perceive and interpret it from a very young age. Therefore, like all other languages, physical space also influences the formation of thought" (Rinaldi, 2009, p. 91). According to Hansson (2016), "the ECE room is a flexible medium and a three-dimensional canvas, which can be constantly manipulated and changed" (p. 18).

Seeing materials, things and technologies as performative can.make room for curiosity and receptivity of what is happening, what is being discovered and the unforeseen (Häikiö, 2017). Learning in exploratory and experimental creative processes requires a relation between content, drive and interaction.

About rhizomes and intra-actions in experimental and explorative practices

Experimental and explorative methods in creative activities are strategies to make new discoveries. According to Welsch (cited in Blume, 2015), things are explored in new ways, and an experimental practice opens up spaces of infinite potential. Experimental processes require creative wealth, reflection and a driving force, and the process is advanced by a continuous change in and through observation and action. Experimental processes seek something that is not defined in advance, something that results from action. This requires being open to the unforeseen and building on an understanding that intuitive elements occur through explorative processes (Blume, 2015). It is about letting coincidences happen and seeing the value in them. Such processes can be seen as assemblages of things, ideas and structures that move like waves and create new connections and becomings, enabling the development of new knowledge and insights.

Such a rhizomatic process is not linear; it shoots off in different directions. Linking events and phenomena in different ways, it reshapes and transforms. The term "rhizome" is derived from botany. It has since been developed as a philosophical concept by Deleuze and Guattari (1987) and has been used in recent ECE research and pedagogical literature. The term refers to a type of root system in which the plant has no main root, but a network that shoots new roots in different directions. They intersect and often lie close, like a tissue or carpet, under the soil's surface. Examples of Norwegian plants that grow rhizomatically are the nettle root (Figure 1), wood anemone, polypody and ground-elder. In a creative experimental learning process, the rhizomatic can provide many openings and potentials and innumerable opportunities or "lines of flight" (Deleuze & Guattari, 1987) that can be pursued through open and experimental approaches (Olsson, 2014).

Collective aesthetic learning processes can also allow for enhanced learning through aesthetic doubling (Austring & Sørensen, 2006, p. 172). The knowledge produced in the collective is accumulative, which means that the group's overall knowledge grows faster than if the individual had undergone learning processes outside the collective. The doubling lies in the fact that the participants of the collective support and complement each other's explorations. Knowledge and insights are constantly being developed and shared. We choose to see this not just as doubling but as multiplying.

Figure 1. Nettle Root. E. Korsmo's weeds charts. Exhibited in the Botanical Garden, Oslo.

In art and craft processes, it is not solely the individual and others in a learning collective who interact with each other. The physical environment, materials and tools that are part of a situation, which constitute an assemblage (Deleuze & Guattari, 1987), are important to the processes that take place. A lexical definition of assemblage is a "work of art composed of different materials; also the term for a technique, originally a three-dimensional version of collage" (Assemblage: kunst, 2018). Assemblage as a philosophical concept is related to Deleuze and Guattari's (1987) process ontology and comes from the French word *agencement*, "…a term that refers to the action of matching or fitting together a set of components (*agencer*), as well as to the result of such an action: an ensemble of parts that mesh together well" (Delanda, 2016, p. 1).

> Nor are assemblages exactly things. They are also processes of perpetual self-construction. The French *agencement*, translated as 'assemblage', can mean both an arrangement of things and the act of arranging those things. An *agencement* thus is not just an assemblage of things, but also a process of 'agencing', just as a circuit of desiring-machines is a 'machining' of machines, an active bringing-into-existence of its own circuitry. (Bogue, 2007, pp. 145-146)

An assemblage can thus be understood as an arrangement of various units (materials, objects, bodies) and the performative arising from the effects of interconnections between the units in an assembly. The aesthetic learning process can be seen as an intra-active phenomenon that incorporates both people and non-humans into the collective, meaning-making process. The perspective is shifted from inter-active relationships to intra-active phenomena that encompass both living and non-living actors in the environment of a given situation. In intra-active phenomena, different identities operate in a common process whereby both meaning and form are created (Barad, 2008; Carlsen, 2015). With this perspective, power is shifted and distributed from people acting unilaterally in the process to the

vibrating and active spaces between people, things and materials as performative in both the process and assembly. In ECE, this can mean that it is possible to understand the sand in the sandbox, the clay, the building blocks and the dough as actively participating with the children in creative processes. Similarly, the students' exploration of, for example, a dried leek flower (see Figures 5 and 6) and exchange of knowledge are entirely dependent on the interaction with tools such as a touch device, smartphone and projector. Physical materials, along with the digital tools and applications available, provide direction for what is possible to explore in the context. At the same time, the expressions and knowledge produced along the way are left open.

Technologies, tools and embodiment

"No object considered purely in and for itself, in terms of its intrinsic attributes alone can be a tool. To describe a thing as a tool is to place it in relation to other things within a field of activity in which it can exert a certain effect" (Ingold, 2011, p. 56). According to Ingold, tools are things that become tools through performative action and in relation to the material process in which they are used. A saw becomes a tool when someone uses it to cut a piece of wood. To define things as tools is to link them to action.

By using tools, we are acting not only in the world but also in a process of understanding the world (Ingold, 2011). Technology is mainly associated with the human-made world, although some animal species also use tools. However, tool usage relates to the non-human-made world, nature, matter and phenomena. Throughout history, humanity has developed and adopted various technologies, such as tools and machines, into everyday life and creative actions. Technology deals with everything from simple hand tools, such as knives and paintbrushes, to advanced technology, such as robots: "A tool is a sort of extension of the hand, almost an attachment to it or a part of the user's own body" (Gibson, 1986, p. 41). Tools relate to the body in action (Ingold, 2011). Digital technologies, such as touch devices and smartphones, engage in intra-actions with bodies, materials and the environment. The development of digital technologies involves a change in human–machine relations. This is referred to as human–computer interaction (Farr, Price, & Jewitt, 2012). The technology in tangible digital mobile devices with multi-touch features provides opportunities to explore a wide range of perception-based actions (Farr et al., 2012).

Materials, materiality and transmateriality

According to Ingold (2007), materiality is not tangible in the same way as matter and materials. Defining materiality is, therefore, not simple:

> I can touch the rock, whether of a cave wall or of the ground underfoot and can thereby gain a feel for what rock is like as a *material*. But I cannot touch the *materiality* of the rock. The surface of materiality, in short, is an illusion. (p. 7)

Ingold states that materiality is an illusion, but what does this mean? In everyday Norwegian speech, we can say that something is materializing, that it takes shape and becomes visible to us. In her doctoral dissertation, Nordtømme (2016) analysed children's play through space and materiality, writing that she used materiality in her study as a common term for things and materials (p. 1). However, is this what materiality is? Herein, it is concrete and tangible, contrasting Ingold's understanding of materiality as an illusion. Materiality has to do with matter and materials, but it is more than the things and materials that surround us. Materiality can be seen as an intra-active and performative phenomenon (Barad, 2007). It is something that both is and does. It includes the effects of relations, in which sense, it is not tangible and can, therefore, be seen as an illusion – in line with Ingold's definition. Nevertheless, it also relates to something concrete and tangible, the way Nordtømme uses the term. The relations between humans and matter/materials can, as we see it, be termed an intra-active relation with mutual influence between humans and matter/materials. Meaning and form are created in an active space between matter/materials and people in action

(Carlsen, 2015; Lenz Taguchi, 2010), and materiality becomes, as we apply it in this context, the relations between people and materials and the effects that arise from actions in intra-active relations. Materials such as sand, plastic, textiles, paper and water have a substance that can be touched and manually altered. They are materials with physical properties, such as consistency, texture and colour. Some materials are closely related to nature, such as clay, wood and sand, while others are processed or in the process of transformation. Plastic is one such material, which originated in crude oil and, through processing, can end up as cellophane and plastic bags. Knowledge of materials in production processes, in "material flow" (Ingold, 2007), provides insight into the properties of materials, their resistance and opportunities and their affordances (Carlsen, 2015; Fredriksen, 2011; Waterhouse, 2013). Materiality – such as light, shadow, movement, light refraction, and degrees of transparency – experienced, for example, through the camera lens, refers to phenomena that can act as materials. They can be used as elements in creating artistic expressions. These phenomena are volatile and intangible, but it is still possible to process and apply them as material elements in creative processes (Waterhouse, 2013).

Digital materiality (Leonardi, 2010) is made available through technological devices or transformed through printing into two- or three-dimensional expressions or things. The properties of digital materiality differ from those of physical materials and are independent of the conditions of physical materials, such as gravity. The experience of digital materiality is an amalgamation of visual, auditory and physical material, e.g. touching the surface of a touch device. Digital materiality in creative processes can be expressions produced with, for example, video and photos, which are integrated as material components in a room together with other types of phenomena and matter/materials. Physical matter and phenomena are transported through digital tools and transformed in space as a response to various surfaces and textures in the environment. Transmaterial expressions (Munster, 2014) occur when different physical materials and materialities are intertwined with digital materiality (Leonardi, 2010). Transmateriality can be understood as "matter in movement, matter as relations of forces, matter as an energetics" (p. 158). Transmateriality is matter/materials in transformation, not in form but from their physical form to signals and codes processed through digital devices, transported and transformed in time and space.

Ingold (2013) states that "in the art of inquiry, the conduct of thought goes along with, and continually answers to, the flux and flows of the materials which we work with. These materials think in us, as we think through them" (p. 6). Through creative processes, we open up to follow and act with matter and materials in transformations or "material flow" (Ingold, 2013). In such processes, we can exchange knowledge through interactions between people, matter, materials and technology. "To describe the properties of materials is to tell the stories of what happens to them as they flow, mix and mutate" (Ingold, 2007, p. 14).

Methodological entrances

Through participatory observation and collective explorations in the project room, we as teachers, artists and researchers come close to the students' explorations. Through experiments in the project room, insights and relations are developed in relation to materials and phenomena and how they mutually influence each other. Personal experience is an important path through which to access knowledge in qualitative research of an experimental nature (Bresler, 2006; Stake, 2010). In teaching and guidance, we explore together with the students and position ourselves as a/r/tographers (Springgay, Irwin, Leggo, & Gouzouasis, 2008):

> A/r/tography as practice-based research is situated in the in-between, where theory-as-practice-as-process-as-complication intentionally unsettles perception and knowing through living inquiry. (p. xxi)

A/r/tography is a practice-based research methodology within art-based research (Barone & Eisner, 2012; Rolling, 2010). Through this methodology, art, research and teaching (learning) are

interwoven through the researcher, who is an artist, researcher and teacher (A/R/T). Creation and writing complement each other in the study: "it is a process of double imaging that includes the creation of art and words that are not separate or illustrative of each other but instead, are interconnected and woven through each other to create additional meanings" (Springgay, Irwin, & Kind, 2005, p. 899).

A/r/tography is a research methodology that, through a person's actions, performs, curves and twists like a rhizome (Springgay et al., 2008). Methodologically, it is open and unpredictable, driven by creative processes that branch out into becomings: "There are no points or positions in a rhizome, such as those found in a structure, tree, or root. There are only lines" (Deleuze & Guattari, 1987, p. 8), which intersect, diverge, move and curve.

Artistic and creative processes can be understood as ways of exploring the world, or "worldly practices" (Haraway & Goodeve, 1999). Through artistic activity, new knowledge can be produced in exchanges between human and non-human entities in creative intra-active processes (Barad, 2007).

"Learning/creating/inquiring in, from, though, and with situations occurs in the in-between spaces – those spaces that make connections that are often unanticipated" (Irwin et al., 2006, p. 72). Through the three identities of the research position A/R/T (Irwin et al., 2006), which are entangled, different and tangible, we as researchers gain insight into teaching contexts and learning processes through joint exploration, learning and reflecting together with students, i.e. learners who are also creative and explorative. We explore possibilities and potentials in spaces between the human and non-human and the creative, explorative, and learning.

We used excerpts and descriptions of events in the project room as part of the empirical material for this article and our retrospective reflections. The descriptions are a way of recreating some of the experiences from the project room for the reader. The empirical basis of the article as a whole is formed by our preparation for teaching, our own observations, the documentation of the teaching project, collective exploration, students' verbal utterances, processes and expressions, photographs and video.

Scenes from a project room

> We are excited. For many days now, we have been working to prepare ourselves and the large project room for the students' exploration of what we call material and digital landscapes. We are excited because we do not quite know what will happen when the students enter the room. The room is tidy. White podiums have been placed on the floor, creating small plateaus where materials are laid out and arranged in assemblages (see Figures 2 and 3). Kari lends out treasures collected over the years. Here, we find dried red cabbage and slices of dried orange, cones, a dried leek flower, bark, mushrooms, seeds, dried leaves, stones, sand, a reed and pieces of wood – an arrangement of organic things and materials of different qualities and smells … We have also found cardboard, paper, glass, mirrors, cellophane, textiles and mirrors: an arsenal of materials with varying degrees of translucency. There are wooden sticks, plastic tubes, cardboard tubes, plexiglass sticks and much more … We feel our bodies trembling. We want to put our hands in this! Feel, lift, stroke and smell. The fragile qualities of the dried cabbage leaves and congealed seeds fascinate. Light, gauzy, woven textiles join a small nest that has persistently and systematically been woven by a bird. The materials and things invite action in different ways. What happens when the students get into action? Do they want to feel, stroke and explore? Will anyone crush a dried leaf between their fingers and rejoice at the sound being created? Will someone lift a mirror, hold it up against the light, move it back and forth to see how the light is refracted and reflected by the material? Will they feel a desire for the materials? … Students will soon be invited in to explore materials and experience transformations in using different digital tools. Something new is going to happen … Our bodies are trembling, filled with anticipation. We are excited and eager for something wonderful to happen … (Empirical excerpt produced collectively by the authors)

Figure 2. The project room is arranged as an invitation to experimental exploration. Figure 3. Close study of a buck skull.

First act

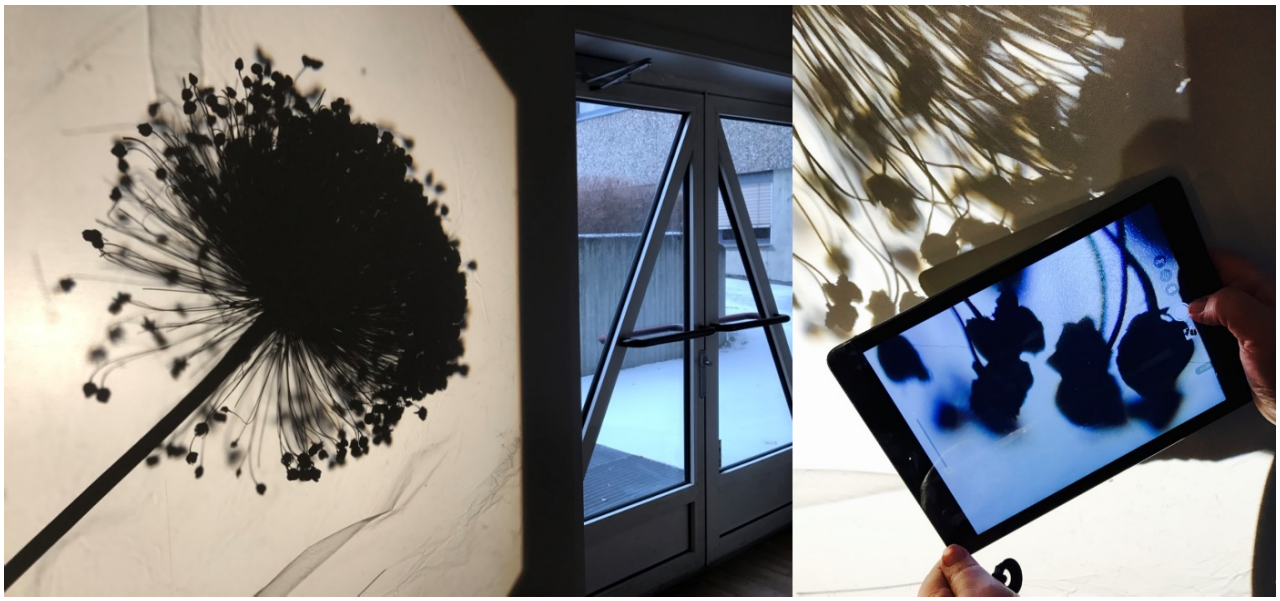
On the first day, students are not given an assignment but, rather, are requested to spend time exploring and experimenting with different materials and tools. At the beginning, things proceed at a slow pace, and several students seem to find it difficult to get started. The framework of the project is open, and we have laid out a few guidelines about where it could end. The first day is set aside to explore, experiment and discover, without thinking about where to go. We let them into this unknown landscape and follow them from a distance. Gradually, larger and smaller groups begin to form, exploring materials in small collectives. We let them be for a while, but then, we are drawn in by our own curiosity and explorative drives. We walk around and discuss things, the textures, colours, applications, motifs, animations, compositions and arrangements of materials in the room. Some groups dissolve, with individual members deciding to work independently. Today, we are teachers in a learning, research and artistic/creative mode.

> *Cod skeleton and macro lens magic*
> Siri has found part of a cod skeleton (see Figure 4). This is one of Kari's many treasures. The bone is part of a skull, and the colour is yellowish white. The bone structure has varying degrees of thickness and different textures. The inner parts of the bone structure are compact, while the outer parts are thin and translucent, almost like paper. Siri places the skull on a shelf of glass inside a glass cabinet and lights it with a flashlight from the underside while taking pictures with her smartphone. She takes pictures from different angles. She continues for a long time. We think that she has found something interesting. After a while, we walk towards her and watch as she takes more pictures. We start discussing the different material qualities of the cod bone. What have captured Siri's interest are form and translucency, but she says that it is annoying that this has not come out so well in the pictures she has taken. We then get a macro lens, which Siri attaches to her smartphone, and we hold the flashlight. We light the skull from different angles, and Siri takes pictures, many pictures. She comes close; she is freer now, since we are holding the light source. The lens does not have the zoom function, so Siri gets close to the cod bone with the phone and her body. The pace increases, as she sees what is revealed on the screen. We do not know if she is aware of this, but she smiles, and we can sense that her energy is building up in line with the discoveries she is making, as the cod skull is transformed into digital materiality on screen. Later, the images of new transmaterial landscapes are projected onto the wall, and sounds are added to the images. (Empirical excerpt produced collectively by the authors)

Figure 4. Cod skeleton seen through a macro lens. Student photo (Reproduced with permission from the student).

In this empirical section, we gain insight into how explorative and experimental approaches to materials can lead to new discoveries through the use of simple and readily available technology. The macro lens magnifies the subject, and the photographer can get closer than with the eye alone. The lens focuss sharply on some parts of the subject, while others become fuzzy and diffuse. A dynamic is created between the sharp and the blurred, which contributes to a great contrast in terms of depth. Most striking are the magnified details that almost stand out from the image's surface. What is perceived is changed through the camera lens. Carving in fishing bones has a long tradition, but here, the material is digitally, not physically, transformed. The cod is transported from physical matter to digital materiality, which is further used in work with video and spatial experimental creations in what we have defined as transmaterial landscapes. In the project room, many such discoveries are made with macro lens magic through studies of materials in flow and shift, moving from physical to digital expressions that fuse together in transmateriality.

Exploration of a dried leek flower and light refraction



Figures 5 and 6. Photo from a student's exploration. Figure 5: A leek flower projected onto the wall. Figure 6: Detail from the student's exploration of a leek flower.

> A dried leek flower and transparent plastic are projected onto a wall in the project room. It is fascinating that proportions can be transformed in this way. The flower is transported from the hand to the entire white wall by light and mirrors (see Figures 5 and 6). Some parts are sharp, while others are more diffuse. This creates depth and variation in the light and shadows that play out on the wall. Colours from the dried flower create shades of brown. As Anne photographs with the touch device, light and shadows turn to digital materiality on the screen. From the dried leek flower transformed to digital materiality and transported out into space, on the wall, on materials, on moving people … transmateriality … (Empirical excerpt produced collectively by the authors)

> Anne describes her experience with the project room as overwhelming, as she senses a lack of control. She expresses that she goes randomly from material to material before something catches her attention. The leek flower has dried up, and time suddenly stands still. The light from the flashlight hits this organic material. Something new and different arises: She is in the process, moving at different angles, taking pictures, continuing, continuing. She puts the macro lens on the touch device, and surprising details appear. She explores, reaching out to feel the texture of the dried leek flower. She gets closer, even closer. Magic! She is in the process … Shadows in moving water have now caught her attention. A glass bowl is projected onto a white wall in the room (see Figure 18). New discoveries. The hours pass by, and she goes on, using phrases such as "being in love with the macro lens" and using them to explore the physical materials. She is on a journey of discovery, engrossed in the process. (Empirical excerpt collectively by the authors)

In her material and digital exploration in the project room, Anne takes over 300 photos on the first day and makes a short video footage of various discoveries. What happens in her exploration and processing of the digital tools and materials in the project room? In the notes from the project, she starts with the experience of the fear of not knowing what to do. She shares this with several fellow students. She feels that she is moving in unfamiliar terrain. Then, she becomes aware of how she can explore the material world in the project room by focusing on the refraction of light in different materials and how they are filtered through the macro lens. Anne discovers various possibilities for action in materials, tools and expressions, and she becomes aware of her own sense perception in the process. We think that she is moving from a visual orientation in the room to a more haptic search for new expressions.

Second act

The students are introduced to the assignment relating to the teaching project, which is to create a video based on the digital expressions produced in the experimentation and exploration of materials and phenomena in the project room. They are encouraged to project their videos onto new assemblages of materials and items (see Figures 8–14).

Different reactions occur in the student group, and we can feel that some of the students are becoming frustrated. Through conversations and guidance, some of them express that they would rather have had the assignment before they started so that they could steer the first day of exploration and experimentation towards the ultimate goal of creating a video. It is easy to understand this frustration. Many learning processes in education are linear, with pre-defined learning outcomes. Exploratory and rhizomatic ways of working are unfamiliar to many and can lead to uncertainty. What do the teachers want? What expectations do we have of the students? How do we as teachers evaluate their work against each other? What criteria are used? What components should the video consist of? Many questions swirl and characterize the energy of the group. While some rush curiously into unfamiliar terrain, others are left at the doorstep and may miss both the map and compass.

The unforeseen

> It smells of hot, burned plastic in the project room. A group of students are frantic and a bit stressed because they have just put coloured cellophane over a warm work lamp to explore how the coloured plastic affects the light. They discover too late that the glass in the lamp is so warm that the plastic melts on contact with it. It shrinks, crackles and burns to the glass plate. They become aware of the heat and the pungent smell. This is an accident which should not have happened because of the fire hazard entailed, but it is going well. When the situation calms down, the students discover that the accident also brings a potential for something new. The melted plastic creates new patterns, textures and shadows on the white wall (see Figure 7). (Empirical excerpt produced collectively by the authors).

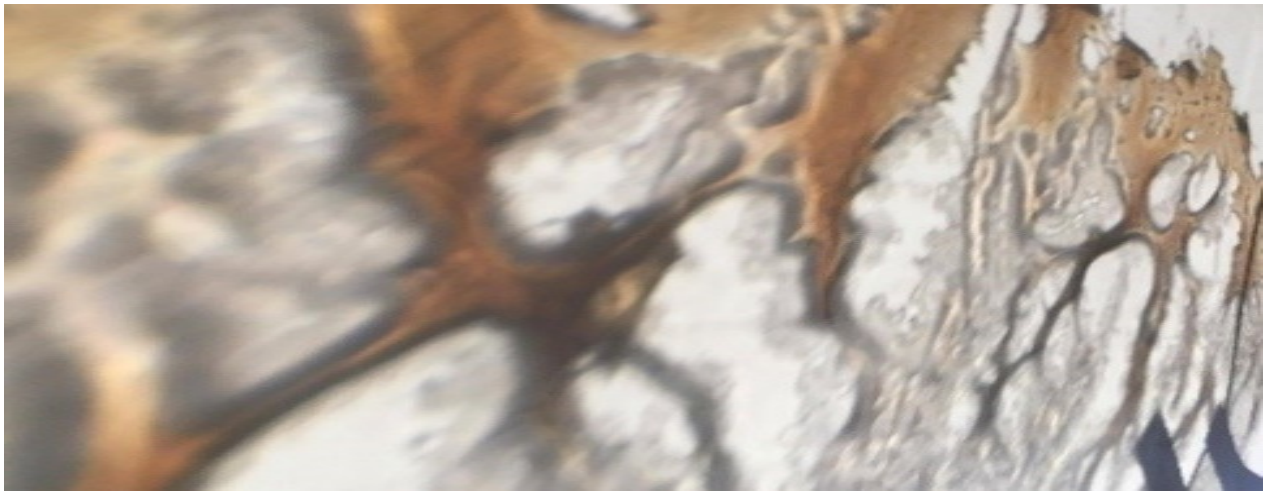


Figure 7. Melted plastic on glass – new digital landscapes on the wall.

Working with explorative and experimental processes necessitates being open to the unforeseen. Some major laboratory discoveries were the result of accidents and incidents, such as penicillin, bakelite (plastic), cola and stainless steel. Discoveries are about being open and searching for what occurs in unplanned occurrences. In this event, the accident is the start of something new.

Figure 8 and 9. Visual excerpts from the processes.

Figure 10–14. Visual excerpts from the processes.

After receiving the assignment, Anne starts planning the next stages of her process. It is difficult to select from the 300 photos she has taken. How does one choose one thing over another? What strategy should she use? Anne has previously worked with planning, implementation and video production, and she is getting started. She finds a line worth pursuing. Something has occurred: There are some qualities that she just has to work on. Something has captured her interest and triggered her. There is something about the monochrome, black and white photos. The monochrome expression and organic forms have a relation, which is enhanced when the photos are put together. She adheres to the organic shapes in the visual material, qualities that are difficult to describe in words. She has worked closely with the macro lens so that the original leek flower is deconstructed, appearing as new lines, shadows and denominations. Through the details, new forms and landscapes are created (see Figures 15–17). (Empirical excerpt produced collectively by the authors)

Figure 15–17. Monochrome excerpts. Close-up studies of shadow in movement. Student Photography (Reproduced with permission from the student).

Third act

It is the last day in the project room. Some students say that they are stressed because they do not yet know what ideas to pursue. Others are nearing the end, which increases the uncertainty of those who are yet to choose an idea. As teachers, we follow closely through guidance and ask students to show us their photos and share their thoughts and ideas so that we can find something of interest to pursue together.

The art of choosing and pursuing discoveries

> Tiril has worked with water and colour in a glass bowl. She is clearly fascinated by the movements that the video transports and transforms when she drips drops of textile colour into the water. Each drop hits the water's surface and creates small ripples before moving down the water in a spiral motion and dissolving. The water becomes slightly discoloured. It is easy to be fascinated by these movements, but the subject excerpt and camera angle could have been better for this phenomenon. Tiril has explored with several colours in the water simultaneously. They blend in and eventually create a murky expression. We guide her to do this again and work on composition, zooming in, going closer and perhaps trying with just one colour. We notice her resistance to repeat the process. This is what it is about, we say: feeling resistance, eliciting what you experience as qualities and fine-tuning the expression. It takes time to create good expressions, and it is about technique and artistry, composition and precision. After a few hours, Tiril shows us new video sequences. She is in the process of editing video sequences in terms of clips, speed and sound. She has also found a feature in the application that plays the movie in reverse. She said that she thought that it would be boring with just one colour in the water, but now that she can change speed, cut and reassemble sequences and modulate the expression with sound, there will be many variations, layers and expressions in what is going to be her video. (Empirical excerpt produced collectively by the authors)

Again, our position as teachers becomes clear, and we experience that we are teachers in processes wherein we explore and create together with students. We have many years of experience in explorative practices; we have in-depth knowledge and insight into the materials, techniques, technology and processes that the students employ. We also have the knowledge and insights to see potential, to enable and materialize ideas. We have the power, zeal and courage to allow movement and innovation in our actions, which will hopefully affect the students. We are not looking for students' answers; rather, we are working to develop their thinking through action, and with thinking comes new questions that can drive processes further, thinking through exploration that gives power to rhizomatic movements. As a/r/tographers, we are dynamic and in movement between our tangled perspectives as artists, researchers and teachers.

Fourth act

Following the teaching project, each student would have collected hundreds of photos, video sequences, thoughts and ideas for further work. In order to get closer to the final phase of exploration and processes in the material and digital landscapes of the project room and the final work on the video, we follow Anne's movements in the landscape.

Discoveries and expressions processed and transformed into video

> Anne continues to work with monochrome expressions in the photos and organic forms, which emerged in the meeting between the light and the leek flower. She works with rhythm, repetition and tempo in her video. She also chooses to use a video clip with shadows and water in movement. This sequence is repeated several times in the video. Anne connects sound with the visual form of things, and in her reflection notes, she shows an understanding of this through her reference to Köhler (1929). She explores the connection of sound and organic form in the visual material. How does the sound of running water work with photos depicting organic expressions with flowing contours? The sound of running water reinforces this fluid, dissolved expression. She seeks and finds sounds that enrich the visual expression. (Empirical excerpt produced collectively by the authors)

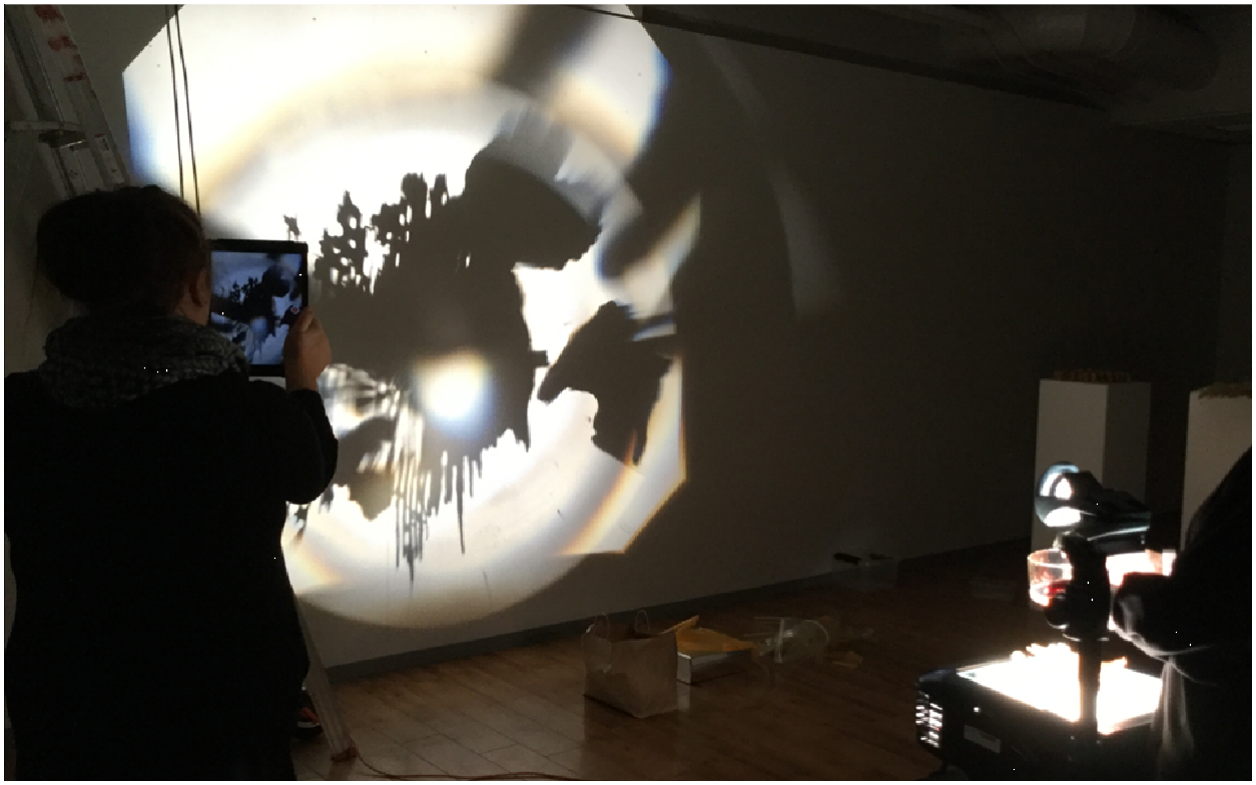


Figure 18. Exploration of water, light, shadow and movement is being projected onto the wall and transformed into digital expressions through the touch device.

Anne follows her lines of flight (Deleuze & Guattari, 1987), and an open, experimental and rhizomatic exploration is replaced by a form of becoming, a process towards a transmaterial expression: a process that accelerates in a new direction, like a new root shot in the rhizomatic process; a process driven by relations, connections and intensities that arise in the interaction between the human and non-human in the experimental.

Retrospective reflections

Through the processes that were explored and developed during the days in the project room, we experienced that these soon-to-be ECE teachers had raised several questions that deepened and differentiated the central research question asked: What happens when we open up to experimental and unforeseen processes that transform physical and digital phenomena into creative processes? Experiences from the study cannot be transferred directly from the students' processes to working with creative processes in ECE. However, these experiences can help them understand what it means to make these discoveries, especially for the first time, and to make discoveries that are relevant to explore in creative digital processes. Further, in this article, we discussed issues emerging during the process in light of the theoretical framework.

The experimental and unforeseen in collectively creative rhizomatic processes

In the teaching project, we have laid the foundation for the students to enter into explorations with an open and experimental approach based on an understanding that there are ways of learning, besides linear and goal-directed processes, that can enable discoveries and opportunities. It takes courage (May, 1975) to let go of safe habits and enter into unknown processes and landscapes, to not know where or what the goal is and to be open to what might occur and pursue the unknown. Many students expressed that they felt resistance when we expected them to be in an experimental process and allow processes to arise and develop. It was challenging for them to create aesthetic expressions by being in the process and not rushing to finish it.

Furthermore, we emphasized the effect of such processes taking place in a collective learning environment, where discoveries are shared, and learning can be regarded as an aesthetic process that bows in different directions, much like a rhizomatic root system. These are collective aesthetic learning processes, and shared knowledge generates more knowledge. In the discussions, new "lines of flight" arose (Deleuze & Guattari, 1987) as potentials and extensions of the landscapes that we created together. Exploring together opened up several avenues. We could see this clearly in the empirical section wherein the teachers entered Siri's exploration of the cod skeleton and became a contributing force in the form of new input and interactions.

The project room turned out to be a laboratory of unforeseen discoveries, which happened accidentally in the case of cellophane, which melted, shrunk and crackled into the glass of the working lamp. This accident resulted in new textures and patterns projected onto the wall. Utilizing this mishap to see something new is about seeing artistic opportunities and affordances in the unforeseen. Although the glass of the work lamp was destroyed with respect to its original function, it acquired a new function through a changed materiality – which the students captured as new formations in the shadow play on the white wall – which was also captured by the camera lens and became a transmaterial expression in new artistic productions. An accident characterized by the smell of melted plastic, coupled with the video media's dimension of time and the possibilities of the room, appeared as transmaterial qualities.

In such processes, it is important to pause and reflect together on what has occurred, what has been discovered and what **else** could be included in the creative process. In a collective learning process, we do this jointly. It became obvious to us teachers how different the students' work was and how differently they evaluated their own processes and products. It was also obvious how difficult it can be to let go of ideas early in the process in order to explore further and in other directions or to find good qualities in the material being explored. Discussing this jointly felt fruitful, opening up thoughts and finding new ways of interacting. We must be clear as teachers and supervisors. We must wait and hold back before revealing or figuring out the students' initiatives, but we must also formulate and expand ideas and opportunities for further creative processes with the students and their discoveries and ideas as artistic guidance.

Technologies and tools

Our experience from the teaching project reveals that tactile, visual and transmaterial qualities

depend on which tools are being used and how. It requires many students to interact with different types of tools and, thus, create new material and digital practices and facilitate a creative process in ECE. The opportunities are present, but seizing them requires a qualified supervisor and, consequently, a qualified ECE teacher to create digital practices that safeguard the exploratory perspective required by the Framework Plan for Kindergartens. Technology becomes performative as a tool through action (Ingold, 2011). Qualities arise in the way that these digital technologies are used and how affordances are materialized (Carlsen, 2015; Waterhouse, 2013). Students use the technologies within the framework of a creative process and search for expressions in a way that differs from what they would have used in a different context. When Anne photographed details of the moving shadows of the dried leek flower, she was not seeking a representation of the leek flower. She was seeking an exploration with the camera and the opportunity to discover something new, something she had not seen before. This is something that the macro lens, the lighting and the dynamics of the situation, together with the leek flower, opened up and allowed. Such use of the camera affected our attention. The tool was in a close, intimate relationship with the gaze and the body in an open, creative process. When the world is experienced through the filter of the camera lens, attention is sharpened through a searching to focus on something and omit something else. It is about making choices and small discoveries in the vast landscape, the assemblages, and their mutual effects: in this case, from the concrete to the abstract. When Anne "fell in love" with the macro lens, it was the technological affordances through her actions and gaze that caused a vibration to happen with the materials and phenomena that she was photographing.

Materials in flow: from matter to transmateriality

Matter becomes performative, as the material of creative processes and work with digital technology and matter/materials are transformed into digital materiality through the camera lens. When digital expressions are transported out into space through the projector to merge with materials, objects and the physical materiality of the wall, we define this as a transmaterial (Leonardi, 2010; Munster, 2014) landscape. Working with the entanglements of physical and digital materiality allows for transformations and new becomings (Deleuze & Guattari, 1987). Transformations can occur as two- and three-dimensional, in movement, tempo, overlap and through projections onto objects. Through this engagement, an ongoing creative process takes place, in which photos from the exploration provide digital expressions that can be re-projected, themselves forming the basis for new photos, images, drawings and collages that, with sound and movement, become video and animation.

In our teaching project, we found that, through action, the room created frames, possibilities, refractions and inter-actions with materials, phenomena and digital expressions. The different textures of the room became performative when photos and video were projected onto the wall. The room's plan and lines were broken when photos and videos were projected onto, for example, a corner or the transition between the wall and the ceiling. In this way, various qualities of the space slipped into and became active components in the exploration and experimentation of transmateriality, and new qualities were articulated. The room as canvas (Hansson, 2016) and the room as language (Rinaldi, 2009) became performative as components in artistic and creative processes.

Toward a new creative and digital practice in ECE

Working in exploratory and experimental ways can open up new creative practices in ECE, where digital technology is integrated as a tool and medium that gives children the opportunity to produce and exchange knowledge through digital practice. In this way, the children's position is shifted from consumers to producers of digital expressions. Being creative in the exploration of digital technology is one of the goals of the Framework Plan, and the creative process can be seen as a mainstay in digital practice in ECE. In the educational project Material and Digital Landscapes, the students developed knowledge of the use of opportunities for creative work with digital technology, including

the use of touch devices. The interface of the touch device is intuitive and largely self-instructional. Therefore, in ECE, there is a danger of the staff leaving the exploration to the children. The Framework Plan states that the staff must "explor[e] creative use of digital tools with children" (MER, 2017, p. 45). An ECE teacher's professionalism is reflected in creating room for real exploration and interaction rather than letting children sit alone with applications where predefined goals dictate what can be followed. The formulations in the Framework Plan (MER, 2017) refer to learning wherein children are understood as explorative, sensing and reflective in their interaction and relations with materials and the environment. Using digital tools and media in working with spatial expression is a way of expanding and multiplying the possibilities of space and tools in everyday experience and creative processes. Emphasizing bodily and sensory inputs in digital technology opens up a richer understanding of what is experienced and learned. Exploring materials and materialities in transmaterial landscapes allows for bodily and sensory experiences with various materials and expressions, both physical and digital. In this way, exploratory digital practices can contribute to renewing and providing new ways of creation in collective learning processes for children and adults in the digital landscapes of ECE.

Ann-Hege Lorvik Waterhouse
Doctoral Research fellow
Department of Visual and Performing Arts Education
University of South-Eastern Norway
ann.h.waterhouse@usn.no

Lovise Søyland
Doctoral Research fellow
Department of Visual and Performing Arts Education
University of South-Eastern Norway
lovise.soyland@usn.no

Kari Carlsen
Associate Professor PhD
Department of Visual and Performing Arts Education
University of South-Eastern Norway
Kari.Carlsen@usn.no

References

Assemblage: kunst [Assemblage: Art]. (2018). I Store norske leksikon [In the large Norwegian lexicon]. Retrieved October 9, 2018, from https://snl.no/assemblage_-_kunst.

Austring, B. D. & Sørensen, M. (2006). *Æstetik og læring. Grundbog om æstetiske læreprocesser* [Aesthetics and learning: Basics in aesthetic learning processes]. Copenhagen: Hans Reitzels Forlag.

Bamford, A. (2012). *Arts and cultural education in Norway.* Bodø: Nasjonalt senter for kunst og kultur i utdanningen [The Norwegian Centre for Arts and Culture in Education]. Retrieved February 8, 2019 from https://kunstkultursenteret.no/wp-content/uploads/2019/01/Arts-and-Cultural- Education-in-Norway-2010-2011.pdf.

Barad, K. M. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning.* Durham, NC: Duke University Press.

Barad, K. (2008). Posthumanist performativity: Toward an understanding of how matter comes to matter.
I. S. Alaimo & S. Hekman (Eds.), *Material feminisms* (pp. 120–154). Bloomington, IN: Indiana University Press.

Barone, T. & Eisner, E. W. (2012). *Arts based research*. Los Angeles, CA: Sage.

Bengtsson, J. (2013). Embodied experience in educational practice and research. *Studies in Philosophy & Education*, 39–53.

Bjerkestrand, M., Fiske, J., Hernes, L., Pramling Samuelsson, I. S., Simonsen, B. & Ullmann, R. (2016). *Barnehagelærarutdanninga. Rapport frå Følgjegruppa for barnehagelærarutdanning til Kunnskapsdepartementet. RAPPORT NR.3* [Kindergartenteacher education. Report from the follow-up group for kindergarten teacher education to the Ministry of Education.]. Retrieved February 8, 2019 from https://www.google.no/search?q=Barnehagel%C3%A6rarutdanninga+Tilbakeve ndande+utfordringar+og+upr%C3%B8vd.

Blume, M. (2015). "Ah, oh, nejjjj!" om eksperimentelle processer i æstetisk pædagogisk praksis ["Ah, oh, no!" about experimental processes in aesthetic pedagogical practice. *Tidsskrift for Nordisk Barnehageforskning* [Nordic early childhood education research journal]*, 9*. http://dx.doi.org/10.7577/nbf.863.

Bresler, L. (2006). Toward connectedness: Aesthetically based research. *Studies in Art Education: A Journal of Issues and Research in Art Education, 48*(1), 52–69.

Bogue, R. (2007). *Deleuze's way: Essays in transverse ethics and aesthetics*. Retrieved February 8, 2019 from https://ezproxy2.usn.no:2537.

Bølgan, N. (2009). *Du gjør bare sånn!: bruk av digitale verktøy sammen med barna* [You just do it like that!: using digital tools together with children]. Bergen: Fagbokforlaget.

Carlsen, K. (2015). *Forming i barnehagen i lys av Reggio Emilias atelierkultur* [Forming in kindergarten in light of Reggio Emilia's studio culture]. Doctoral thesis, PeD. Åbo: Åbo Akademis förlag. Retrieved from http://urn.fi/URN:ISBN:978-951-765-783-9

Delanda, M. (2016). *Assemblage theory*: Edinburgh: Edinburgh University Press.

Deleuze, G. & Guattari, F. (1987). *A thousand plateaus. Capitalism and schizophrenia*. London: Bloomsbury Academic, Bloomsbury Revelations.

Dewey, J. (2005). *Art as experience*. New York: Berkley Publishing Group. (original work published 1934)

Eisner, E. W. (2002). *The arts and the creation of mind*. New Haven: Yale University Press.

Farr, W., Price, S. & Jewitt, C. (2012). An introduction to embodiment and digital technology research: Interdisciplinary themes and perspectives. National Centre for Research Methods Working Paper. Retrieved from http://eprints.ncrm.ac.uk/2257/4/NCRM_workingpaper_0212.pdf.

Fredriksen, B. (2011). *Negotiating grasp: Embodied experience with three dimensional materials and the negotiation of meaning in early childhood education.* Doctoral thesis. Arkitektur- og designhøgskolen, Oslo.

Fredriksen, B. (2013). *Begripe med kroppen* [Grasping bodily and mentally]. Oslo: Universitetsforlaget.

Gibson, J. J. (1986). *The ecological approach to visual perception*. Hillsdale, NJ: Erlbaum. (Original work published 1979)

Gulliksen, M. (2017). Making matters? Unpacking the role of practical aesthetic making activities in the general education through the theoretical lens of embodied learning. *Cogent Education, 4*(1), 1415108. https://doi.org/10.1080/2331186X.2017.1415108

Halland, S., J. & Vist, T. (2016). Estetiske opplevingar. Toddlaren I møte med materiale [Aesthetic experiences. Toddlers meeting with materials. In T. Gulpinar, L. Hernes & N. Winger (Eds.), *Blikk fra barnehagen* [A view from early childhood education]. Bergen: Fagbokforlaget.

Hansson, H. (2016). *En barnehage til begjær. Å gi form til barnehagens innhold* [A desirable ECE: Shaping ECE content]. Bergen: Fagbokforlaget.

Haraway, D. (1988). Situated knowledges: The science question in feminism and the privilege of partial perspective. *Feminist Studies, 14*(3), 575–599. https://philpapers.org/archive/HARSKT.pdf.

Haraway, D. (2012). Awash in urine: DES and Premarin® in multispecies response-ability. *WSQ: Women's Studies Quarterly, 40*(1), 301–316. doi:10.1353/wsq.2012.0005.

Haraway, D. & Goodeve, T. (1999). *How like a leaf: An interview with Donna Haraway*. New York: Routledge.

Haug, K. H. & Jamissen, G. (2015). Se min fortelling. Digital historiefortelling i barnehagen [See my story. Digital storytelling in kindergarten]. Oslo: Cappelen Damm Akademisk.

Häikiö, T. (2017). Dokumentation, transformation och intra-modala materialiseringer [Documentation, transformation and intra-modal materializations]. I. B. Bergstedt (Ed.), *Posthumanistisk pedagogik. Teori, undervisning och forskningspraktik* [Posthumanistic pedagogy. Theory, teaching and research practice] (pp. 59–82). Malmö: Gleerups.

Ingold, T. (2007). Materials against materiality. *Archaelogical Dialogues, 14*(1), pp. 1–16. http://dx.doi.org/10.1017/S1380203807002127

Ingold, T. (2011). *Being alive. Essay on movement, knowledge and description*. London: Routledge.
Ingold, T. (2013). *Making. Anthropology, archaeology, art and architecture*. New York: Routledge

Irwin, R., Beer, R., Springgay, S., Grauer, K., Xiong, G. & Bickel, B. (2006). The rhizomatic relations of a/r/tography. *Studies in Art Education, 48*(1), 70–88. Retrieved May 12, 2020, from www.jstor.org/stable/25475806.

Jacobsen, H, Koefoed, T. & Loi, M. (2015). *Barnehagemonitor 2015. Den digitale tilstanden i barnehagen* [A mapping survey about the digital condition of Norwegian ECE]. Oslo: Senter for i IKT i utdanningen. Retrieved from https://www.udir.no/globalassets/filer/tall-og forskning/rapporter/2016/barnehagemonitor-2015.pdf.

Kleinman, A. (2012). Intra-actions: An interview with Karen Barad. *Mousse Magazine, 32*, 76–81. Retrieved from https://www.academia.edu/attachments/26071995/download_file?st=MTU1NjQ1MDgxNyw4NC4yMDkuMTguNDEsOTkzMzgwNQ%3D%3D&s=swp-toolbar&ct=MTU1NjQ1MDgyMSwxNTU2NDUwODMxLDk5MzM4MDU=.

Köhler, W. (1929). *Gestalt psychology.* New York: Liveright.

Letnes, M. A. (2014). *Digital dannelse i barnehagen. Barnehagebarns meningsskaping i arbeid med multimodal fortelling* [Digital bildung in kindergarten – Children's meaning making in the face of production of multimodal texts]. Doctoral thesis. NTNU, Norway. Retrieved April 8, 2019, from https://mariannletnes.files.wordpress.com/2010/11/digital-dannelse-i-barnehagen-avhandling-2014.pdf.

Lenz Taguchi, H. (2010). *Bortenfor skille mellom teori og praksis. En introduksjon til intra-aktiv pedagogikk i barnehagefeltet* [Beyond the distinction between theory and practice. An introduction to intra-active pedagogy in the kindergarten field]. Bergen: Fagbokforlaget.

Leonardi, P. (2010). Digital materiality? How artifacts without matter, matter. *First Monday, 15*(6). https://doi.org/10.5210/fm.v15i6.3036.

May, R. (1975). *Mot til å skape* [Courage to create]. Oslo: Aventura Forlag

Ministry of Education and Research (MER). (2011). Framework plan for kindergartens. Retrieved April 8, 2019, from https://www.udir.no/laring-og-trivsel/rammeplan/barnehagens-innhold/rammeplan-for-barnehagens- innhold-og-oppgaver/.

Ministry of Education and Research (MER). (2017). Framework plan for kindergartens. Retrieved April 8, 2019, from https://www.udir.no/globalassets/filer/barnehage/rammeplan/framework-plan-for-kindergartens2-2017.pdf.

Moser, T. (2014). Læring og Kropp [Learning and body]. I. J. Heldal Stray & A.-L. Wittek (Eds.), *Pedagogikk. En introduksjon til utdanningsvitenskap* [Pedagogy – An introduction to educational science] (Chap. 14; pp. 251–269). Oslo: Cappelen Damm Akademisk.

Munster, A. (2014). Transmateriality: Toward an energetics of signal in contemporary mediatic assemblages. *Cultural Studies Review, 20*(1), 150–167. doi:10.5130/csr.v20i1.3836.

Nordtømme, S. (2016). På vei mot en rom(s)lig pedagogikk: En fortolkende studie av barns lekerfaringer med rom og materialitet [Towards a spatial pedagogy. An interpretive study of children's play experiences with space and materiality]. Doctoral thesis, University of Southeaster Norway, Kongsberg.

Olsson, L. M. (2014). *Rörelser och experimenterande i små barns lärande. Deleuze och Guattari i förskolan* [Movements and experimentation in small children's learning. Deleuze and Guattari in early childhood education]. Lund: Studentlitteratur.

Otterstad, A. M. (2016, 3 April). Fellesskap forsvinner fra barnehagen [Community disappears from early childhood education]. *Khrono.* Retrieved from https://khrono.no/debatt/skape-barnehagelaerere-som-instruktorer-og-barna-som-passive-tilhorere.

Raja V., Biener Z. & A. Chemero (2017). From Kepler to Gibson. *Ecological Psychology, 29*(2), 146–160. doi.org/10.1080/10407413.2017.1297186.

Rinaldi, C. (2009). I dialog med Reggio Emilia – lytte, forske og lære [In dialogue with Reggio Emilia – Listening, exploring and learning]. Bergen: Fagbokforlaget.

Rolling, J. H. (2010). A paradigm analysis of arts-based research and implications for education. *Studies in Art Education, 51*(2), 102–114. doi:10.1080/00393541.2010.11518795.

Springgay, S., Irwin, R. L. & Kind, S. W. (2005). A/r/tography as living inquiry through art and text. *Qualitative Inquiry, 11*(6), 897–912. https://doi.org/10.1177%2F1077800405280696.

Springgay, S., Irwin, R., Leggo, C. & Gouzouasis, P. (Eds.) (2008). *Being with a/r/tography*. Rotterdam: Sense Publishers.

Stake, R. E. (2010). *Qualitative research. Studying how things work*. New York: Guilford Press.

Thelen, E. (2000). Motor development as foundation and future of developmental psychology. *International Journal of Behavioral Development, 24*(4), 385–397.

Waterhouse, A. H. L. (2013). *I materialenes verden: Perspektiver og praksiser i barnehagens kunstneriske virksomhet* [In the world of materials. Artistic perspectives and practices in early childhood education]. Bergen: Fagbokforlaget.

Waterhouse, A.-H. L. (2016). Den gode barnehagekonserten. Om kvalitet i musikalske møter mellom barn, musikk og utøver [The good kindergarten concert. About quality in musical meetings between children, music and performer]. I. H. Jæger & J. K. Torgersen (Eds.), *Barnekultur [Children's culture]*. Oslo: Cappelen Damm Akademisk.

Østrem, S., Jar, H., Føsker, L. R., Jansen, T. T., Nordtømme, S. & Tholin, K. R. (2009). *Alle teller mer. En evaluering av hvordan Rammeplan for barnehagens innhold og oppgaver blir innført, brukt og erfart* [Everyone counts more. An evaluation of how the framework for the kindergarten's content and tasks is implemented, used and experienced]. Report 1/2009 Tønsberg: Høgskolen i Vestfold. Retrieved from https://brage.bibsys.no/xmlui/bitstream/handle/11250/149122/rapp01-2009-alle-teller-mer.pdf?sequence=1.