Laamanen, Tarja-Kaarina; Mäkelä, Maarit; Seitamaa-Hakkarainen, Pirita

Material-led creative processes in the context of design education

**TARJA-KAARINA LAAMANEN**
Independent Scholar

**MAARIT MÄKELÄ**
Aalto University

**PIRITA SEITAMAA-HAKKARAINEN**
University of Helsinki

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## ABSTRACT

*This article discusses research from the Design Experimentation and Exploration (DEE) course in the higher education context. The DEE course was designed to support MA design students' understanding of their creativity in an explorative course. The data were drawn from the students' weekly and final reflections, as well as from the notes by one of the researchers. We were interested in how material-led processes developed through repeated material explorations and experimentation during the DEE course. We found that, in this context, the material process was related to identity building, overcoming challenges in idea development, and conceptual inquiry. The results highlight how materials and making can intertwine with personal goals. They thus provide an example for educators in other contexts to support students in bravely following uncertain processes, letting go, and experimenting freely.*

## INTRODUCTION

The present multiple case study aimed to analyse qualitatively how material-led creative processes evolved during the Design Exploration and Experimentation (DEE) course. DEE was an MA-level elective course from the collaborative and industrial design curriculum offered by Aalto University, Finland. All the participating students were seniors who had some professional design experience. DEE provided a course platform that consisted of numerous tasks involving the documentation of the creative process and reflections on it (see Kosonen and Mäkelä 2012). This pedagogical platform was designed twelve years ago to address the need for proper studio practices. Teachers thought that students would benefit from a process typical of fine art, which would involve the personal, unique expression of each student and highlight explorative ways in design. The DEE course thus brought together art, craft and design. The course experiments with how artistic and 'designerly' ways of working can feed off one another (Kosonen and Mäkelä 2012; Cross 2006). A designerly way of working means that problem and solution co-evolve during the creative process (Dorst and Cross 2001). The design of the DEE course emphasized the material part of learning by doing, that is, how engagement and entanglement with materials and tools generate insights by provoking both human and non-human others (Fenwick et al. 2012).

The course's main objective was to combine a creative process and free expression with different materials and techniques so that, by the end of the course, the students would be able to exhibit an artefact, that is, an art/craft piece or design. The course plan involved initially familiarizing the students with a chosen theme, then travelling to the chosen destination for inspiration and finally engaging in personal projects. The course aimed to provide the students with the skills necessary to control their creative process by documenting and reflecting on the process in written form.

During the course, the MA design students were encouraged to push their boundaries and develop personal themes at the edge of, or even outside, the traditional industrial design context. At present, industrial design teaching is typically based on concept development, where ideas are shared via sketches and prototypes. Projects are conducted in groups and often based on clients' or customers' needs. Therefore, the designer's personal approach and material exploration do not necessarily get much attention during these projects. At the same time, the requirements for design expertise have become demanding, moving from product design to dealing with difficult ecological and social challenges at the global level (Adams 2018; Ceschin and Gaziulusoy 2016; St. Pierre 2019). This approach requires enhanced creativity that goes beyond established knowledge. It also calls for fundamentally changing perspectives (Welch and Loy 2013) as well as understanding individual creativity in depth (Kosonen 2018). When considering design practice, shifting the focus beyond usability to embrace uncertainty, expression, interpretation and meaning-making offers a complementary perspective to dominant thinking and applications (Malpass 2017: 51).

Design practices and entire making processes are entangled with various materials, sketches, resources and artefacts. Materiality and artefacts should be seen as substantial components of creativity (Tangaart 2012). Materiality refers to our perception and experiences of our surroundings, for example, the texture of an artefact or raw material. Material exploration supports design and artistic processes in making discoveries. Furthermore, experimentation (i.e.

trying things out) is an important method of learning, creating knowledge and making sense (Danvers 2003; Groth 2017). Material exploration and experimentation can be seen as important working methods for artistic processes. Studying material qualities creates associations on many levels, extends thinking and helps decision-making (Kosonen and Mäkelä 2012). In this study, we were interested in how students' material-led processes developed through repeated material explorations and experimentation during the DEE course.

In the following section, we introduce our theoretical framework related to materiality. We then describe in more detail the DEE course context and the participants, as well as our qualitative data collection and analysis methodology. Finally, we report our results and discuss them with reference to art and design education.

## THE MATERIALITY OF IDEA EVOLUTION

This study examines students' material-led processes that involve efforts to advance ideas through repeated material explorations and experimentation, which provide various sources of inspiration and may significantly shape and transform ideas. The study thus expands the realm of design studies that analyses designing and acknowledges the use of tools, practices and sources of inspiration as well as the role of previous experience (see, e.g., Jonson 2005; Petre et al. 2006; Heylighen and Neuckermans 2002). These studies have enhanced our understanding of how to support students and practitioners in producing creative ideas (Laamanen and Seitamaa-Hakkarainen 2014). Strong ideas are valuable in design because they have the potential to lead to creative and innovative products (Goldschmidt and Sever 2011). However, we have noticed that learning how to produce a range of ideas, while important, is not sufficient. What is crucial is being able to identify a successful idea and how it can evolve towards a meaningful outcome (Toh 2014; Watts et al. 2019). Therefore, in this study, we will focus on how students developed and materialized ideas during the DEE course.

When the situation is unfamiliar, such as in our case with the application of artistic methods and making, there might occur a surprise that leads to rethinking the applied practices. Ideally, the challenge stimulates a sense of enquiry and curiosity in the learner (Garner and Evans 2015). In design, curiosity is essential as it underpins and motivates the search for solutions (Garner and Evans 2015). In addition to curiosity, designing requires personal imagination and meaning-making. Various domain-specific, contextual and personal variables influence how new and unknown situations are faced. The life story, cultural background, upbringing and current situation of an individual impact their ways of learning and working, and vice versa (Kosonen 2018).

All these variables have an impact on the creative process, which (often) starts with idea generation. Idea generation involves several practices, such as gathering information, collecting sources of inspiration (Keller et al. 2006), sketching and reflecting (Mace and Ward 2002; Schön 1983). These practices aim to crystallize a key idea. 'Key' refers to an idea's capacity to hold several lines of thought and thereby avoid a premature commitment. A key idea has the potential to constrain the creative process and at the same time inspire new meanings when it evolves into an explorative process (Laamanen 2016; Darke 1979). Thus, it creates a standpoint from which the task can be framed and tackled. Mace and Ward (2002) studied artists and their creative processes. They found that creative professionals develop clear ideas by exploring

intricacies, thereby extending the richness of form and content and simultaneously increasing the artist's knowledge and understanding. The exploration and expansion of the network of meaning ensure that the idea becomes personal if it did not already derive from a personal experience (Mace and Ward 2002: 184; see also Löytönen and Mäkelä 2017).

Furthermore, design researchers (e.g. Jacucci and Wagner 2007; Ramduny-Ellis et al. 2010) have emphasized that designing is material-centric and that interacting with and through physical materials is an intrinsic part of the process. Creating an object involves a transformation of physical materials. Idea materialization can be seen as an entanglement of artist and matter, where the human maker learns from matter and thinks with it. When the idea begins to materialize, it transforms into a conceptual and physical entity. The concept will inform the physical structure and vice versa; the making phase will define the concept of the work. It is a process of development in which content and form influence each other (Mace and Ward 2002: 185; see also Löytönen and Mäkelä 2017). For designers, the practice of manipulating materials is like having a conversation with the developing object. Any material object can potentially be perceived and explored in the cyclical seeing-moving-seeing process where each movement, such as drawing a line, suggests a new movement or association, thus simultaneously guiding the generation and development of the idea (Schön and Wiggins 1992).

A recent theoretical development of making acknowledges the agency of matter as equal to human agency (Malafouris 2008). Many authors (Bolt 2013; Ingold 2013; Malafouris 2008) use art and craft practices as examples for discussing their material-related thinking. For artists, designers or artisans, material experimentations play a significant role in the formation of concepts, the exploration of material variations and the final artefact. Materials generate insights by provoking human and non-human others. From this perspective, learning to pay attention to how materials move, inspire and challenge physically and emotionally is essential. This means that material engagement requires attention and awareness through interaction with one's surroundings and that knowledge comes from direct material engagement with the world (Ingold 2013). Making thus becomes a shared process between humans and non-humans (Aktaş and Mäkelä 2019; Malafouris 2008; Ingold 2013).

## METHODOLOGY

### Setting and participants

This multiple case study was conducted in the higher education context. The data were collected from the eight-week DEE course held at Aalto University in 2014. A group of six MA design students of four nationalities participated in the study. Three students were Finns, and the other three were exchange students from Italy, the United Kingdom and South Korea. All the students were seniors who had some professional design experience. Patrik had a background in communication design. Roosa had a BA degree in design from an applied university and was working as a game designer while pursuing her studies. Pekka had an artisan degree and a BA in industrial design, as well as fifteen years of experience as a carpenter. Dae and Olivia had product design BA degrees. Heikki had BA degrees in blacksmithing, computer programming and industrial design.

During the DEE course, the students documented their progression and reflections in three forms: (1) working diaries, that is, personal diaries used as

*Figure 1: Experiencing Lapland. Photographs by Olivia.*

self-communication tools; (2) weekly reflections, that is, assignments that were shared with the teachers to communicate the student's progress, problems, insights and other issues related to creative processes; and (3) final reflections submitted after the course was over, which showcased the students' critical reflections on the entire learning process. The students could use different studios when working on their individual tasks and producing their final artefact. This work was supported by tutoring sessions, lectures, excursions and literature assignments.

Each year, the DEE course has an overarching theme; in 2014, it was 'journey'. The course also includes a five-day trip, which in 2014 was to Luosto in Lapland. The students, two teachers and one research assistant travelled to Luosto to experience the local nature and culture and to get to know each other. In addition to several formal and informal discussions, the trip to the snowy and ice-cold north included exercises, lectures and visits (Figure 1). One of the visits involved a local Sámi woman in her folk dress. The group also visited a reindeer farm. Furthermore, the group members participated in a shamanic ritual to find their power animals. This event was organized by a researcher whose academic interest is Sámi shamanism (Joy 2018). These activities created strong emotional experiences, which the students drew on when they returned to university and started developing their creative projects.

After the trip to Lapland, the course continued at the university. Its schedule was as follows: Mondays, Wednesdays and Fridays were reserved for individual work, enabling the students to develop their ideas, reflect on their process and complete assignments; Tuesdays and Thursdays were dedicated to sharing and discussing the progress of the creative process, followed by feedback from peers and teachers. Tuesdays and Thursdays were also used for lectures and discussions, as well as visits to local museums and galleries. Furthermore, the students had the opportunity to receive individual tutoring sessions (for a more detailed description, see Kosonen and Mäkelä 2012; Löytönen and Mäkelä 2017).

## Data collection and analysis

Each student's process represents a case in this study. Throughout the course, the students kept personal working diaries and wrote weekly reflections to document their processes. The students also wrote final reflections after the course. Weekly reflections (a total of 33 pages) and notes by one of the researchers of weekly meetings (40 pages) were used as the main sources of

data. The students' final reflections (149 pages) were used as supplementary data.

According to Yin (2014), the case study is a suitable means for empirically investigating a phenomenon within its real-life context. The case study is well suited to (1) 'why' and 'how' questions, (2) naturally occurring situations, (3) situations where the context is crucial and (4) those where the boundaries between phenomenon and context are blurred (Yin 2003: 9–13). In this study, the multiple case study design was adopted to analyse each case in depth.

To understand how material-led processes supported students' evolving key ideas, we traced each student's process using qualitative content analysis (Krippendorff 2012). Our data-driven qualitative content analysis enabled us to combine earlier theories into our investigation (Hsieh and Shannon 2005). The analysis had three phases.

First, we organized process-related text from the students' weekly reflections into chronological matrices for each student. The students' reflections on their processes were loosely organized following the four phases of the creative process suggested by Mace and Ward (2002): (1) conception and idea generation, (2) idea development, (3) artwork making and idea development/ refinement and (4) completion and resolution.

In the second phase of the analysis, we traced the students' key ideas, practices, goals and learning reflections (see Table 1). These themes exhibited connections to existing theories and helped us understand the material features of the students' processes.

All six students' key ideas became personal through the bodily and visual experience of the harsh climate, the local culture and the visions experienced during the rituals in Lapland. Roosa focused on what creativity is; Olivia concentrated on heritage, while Patrik chose 'contrasts' as his key idea. Heikki's key idea was Leuku, a traditional tool that he associated with Lapland. Pekka and Dae focused on personal and professional growth.

The students used the following five practices that helped them to evolve their key ideas further: interacting, information gathering, using sources of inspiration, experimenting and making, and drawing. The DEE course was built on learning through interacting. The students brought their ideas and experiments to the course meetings; they gave individual presentations and grouped around artefacts or other documents to discuss them. Information gathering and using sources of inspiration were built into the course plan. As the students presented their ideas, the teachers suggested sources to look for, for example, books, articles and sometimes also professionals. Hands-on activities such as experimenting and making were the core of the course. The students received support in crafting and materializing ideas, testing them with different mediums, trying out ideas and making the outcome themselves. Drawing was seen as one of the hands-on activities; it was understood as an explorative practice to create visuals and reinterpret them in the creative process.

In the third analytical phase, we traced and interpreted how the students emphasized practices and how their key ideas and related goals evolved. We compared and cross-examined our interpretations of the students' reflections, and after rigorous review and discussion, we formulated and typified them into three main approaches: (1) identity building (Pekka and Dae), (2) overcoming challenges in idea development (Patrik and Heikki) and (3) conceptual inquiry (Roosa and Olivia). In other words, Pekka and Dae used experimenting and making and drawing as their main practices to build their identities. Patrik and

*Table 1: The chronological matrix for organizing and analysing the data. An extract of the colour-coded analysis of the students' reflections in the making phase. On the left are process phases and course content. In the middle are colour coded quotes. Codes were: search for information (light blue), making and experimenting (green), key idea (red), the use of sources (light pink), the interacting (turquoise) and reflections on the evolving personal goal (yellow). On the right are notes from the weekly meetings.*

| Process phases | Course content | Selected quotes and analysis | Researcher's notes |
|---|---|---|---|
| | | Colour codes:<br><br>xx = information gathering xx = making and experimenting xx = key idea xx = sources of inspiration xx = interacting xx = drawing xx = reflections of personal goal xx = reflections of learning<br><br>W = week, WR = weekly reflection, FR = final reflection, N = notes | |
| Making the artwork and idea development: Restructuring the idea | 4.2 Group meeting/ presenting an artist | *W4. As always, the reflection starts right after the presentation on Tuesday and especially after the feedback. I was well aware that I, while I was already quite advanced in the prototyping part, given also the fact that making a simple kaleidoscope proved to be not hard at all, I had to take a step back from the physical side and analyse my ideas, put them in a sharper light. From a physical point of view, I got reminded of the spatial element that comes with the responsibility of setting up an exhibition; something I've never really done before. The visit to the Kiasma HITS exhibition was of great inspiration in this sense. I found understanding and experiencing in a clear way the concept of entering the work of art in Jacob Dahlgren's multicoloured installation. (Patrik, WR)* | Lukee kuvauksia, suoria lainauksia näyttely teksteistä. *Serie "Roman road" kiinnostui myös kovasti, kaleidoskoopeista.* Puhuu hyvin nopeasti ja Maarit pyytää hidastamaan. Pitää kovasti, että näissä roman road kuvioissa näkee kasvin, alkuperän. Analysoi viime viikon lähtökohtaa ja oli |
| | 6.2 visit to Kiasma museum | *W4. I concentrated my attention in this sense, in a session of brainstorm at home, of the sort where you tell yourself 'now, sit down and think hard'. What came out of that didn't convince me at all. Enlarging the scale of the kaleidoscope, using videos and projectors instead of the real object, using sounds; all ideas* [...] *analysis continues* | |

Heikki used experimenting and making practices to overcome a challenge and learn a new explorative approach to a creative process. Roosa's and Olivia's approaches focused on information gathering and the use of sources as a basis for conceptual inquiry. In the following section, we will deepen our analysis by presenting one case from each of the three groups.

## RESULTS

### *Explorative hands-on activities mediate identity building*

During the DEE course, the students were prepared to invest time in a more personal process than in traditional design cases. In particular, two of the students, Pekka and Dae, wanted to build their identities. Pekka sought to challenge his professional identity, and Dae wished to develop himself as a person. Pekka's case will be presented next.

For his creative process, Pekka had three starting points: carving without purpose, casting mummified rats and an urban sanctuary. The background theme was to create a 'metaphysical room', which would be a spiritual entrance to the world of art, design and craft. Pekka understood from the beginning that during the course, his making would go beyond physical artefacts to reach his goals, intentions, emotions and projections (see Mace and Ward 2002).

Two of Pekka's starting points were related to wood, a material with which he was very familiar. Having already a degree as a wood artisan, he had always used wood for certain purposes. As a skilful craftsman, he believed that eight weeks were insufficient to learn a new material, so he decided to study wood from a new, artistic perspective. Therefore, as his main practice, he began to carve without purpose, which was a completely new way of working for him (see Figure 2).



*Figure 2: Pekka describes his carving process in a meeting by showing the important part in the original log. Photograph by Maarit Mäkelä.*

During week 4, Pekka wanted to start working on his other two projects. This was opposed in the group meeting. Instead, he was advised to go out of his comfort zone and clarify his making, so that he could create room for deeper research. He was also advised to talk with an artist to demystify the artistic work. At first, he rejected this feedback. However, upon reflection, he appreciated that he was pushed to a turning point in his making, which he described with the following words:

> There is a recognizable path. First, the chunk looks ordinary, even boring. After studying it carefully, all these little qualities appear, e.g. fine bark structures, which I usually just get rid of, or tender shapes on the surface, which make [the chunk] unique. With this aspen, I rethink my professional approach. Before, I described my working habits with an overlapping triangle of Maker, Material, and Need. Now, I challenge myself to bond with the material fully. Only after this strong relationship between me and the tree can something meaningful come out.
>
> (Pekka, weekly reflection, week 5)

As Pekka explains above, in this project, he created a tight bond with the material. He worked closely and slowly with the selected wood chunk by listening and reacting to the material (Mäkelä and Aktaş 2022: 28; Ingold 2013: 31). Concentrating on unplanned, explorative making supported Pekka's new understanding of the material and the ways of crafting it. Explorative making provided important surprises, as he was not familiar with the artistic way of crafting wood. Before, Pekka would have removed the fine parts of the bark and ignored the surface of the wood. Now, he focused on seeing and using the wood as a whole (Figure 3).

During week 6, the main revelation occurred in Pekka's process – his making, emotions and search for a professional identity as a designer merged into one. Pekka had been going through a challenging chapter in his life because his mother was terminally ill. He thus decided to carve with an emotional charge to process this situation. The excerpt below and Figure 3 show the transformation from sorrow to the physical artefact:



*Figure 3: Transforming sorrow into a physical artefact. Photographs by Pekka.*

I was embarrassed because I originally wanted to do something 'good-looking'. But I immediately realized the link with my mother's situation. I accepted this ugliness. Now I feel that I managed to transform my sorrow into the form of wooden face fragments. I also climbed over those outer expectations that have been difficult to deal with, e.g. am I doing real art? Or can I achieve a certain quality level? These issues don't really matter anymore. My sorrow is now in physical form, and I can carry it out of our home.

(Pekka, weekly reflection, week 6)

During week 7, Pekka met a professional wood artist. After this encounter, he felt that he was establishing his identity as an artist. He placed carved works on stands and finalized several self-standing statues for the exhibition, which were his outcomes for the course (Figure 4). Pekka's case illustrates deep concentration in material practice and a dialogue in which the material spoke back. This dialogue gradually guided his process and defined his new identity as an artist.

### Overcoming challenges through material exploration

When the DEE course started twelve years ago, industrial design teaching had already separated from the material and experimental realm that was once an important part of it. As explained earlier, the collaborative and industrial design students were familiar with using a conceptual approach to design, whereas the sphere of material exploration and experimentation



Figure 4: One of Pekka's sculptures in a gallery. Photograph by Krista Kosonen.

was new to them. Another element that was considered valuable was personal decision-making, given that most of the exercises in the collaborative and industrial design programme are conducted in groups. Both studio skills and the management of personal creative processes were seen as valuable abilities for the programme, which led to the creation of the DEE elective course. For the students, switching from their previous orientation to an experimental approach was not easy. 'Out of my comfort zone' was a phrase that the students used not only when experiencing the unfamiliar process but also when experimenting with new materials. Heikki's and Patrik's processes exemplify these challenges: Heikki was struggling to move to the exploring phase with his new material, and Patrik was finding it difficult to overcome his typical conceptual design approach. Below, we unpack Patrik's process.

Patrik's case highlights the contradiction between the design orientation that students were familiar with and the new approach required by the DEE course. In the group meeting after the trip to Lapland, Patrik introduced three starting points: the Sámi brooch and its meanings, outdoor–indoor contrasts and conquering the Lapland peak.

From the beginning, Patrik had an idea inspired by a Sámi brooch. He explained how easily it had emerged and evolved into a relatively clear idea. It would become a customizable tag for travellers, which would reveal some of the wearer's personal characteristics, like a Sámi brooch (Figure 5). This idea generated a discussion in the weekly meeting. The other students noted that some people are not keen on disclosing their personal characteristics and the teacher reminded the group that tagging people might raise negative associations. As material exploration and experimentation were new skills to be learnt for the course, Patrik was advised to start experimenting and avoid using his typical conceptual design approach. The following excerpt reveals how he felt when he considered applying this new working method as a designer:
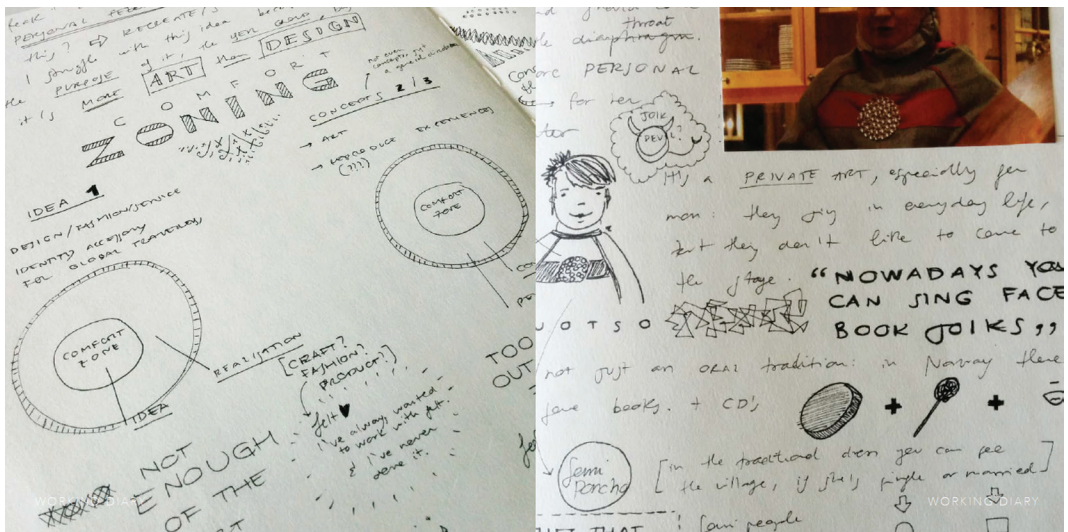


*Figure 5:  Patrik's working diary. Photograph by Patrik.*

> The research assistant's comment was the one that left the biggest mark. The work methods I have always seen as my assets – profound rationalization and systemic reflection – were being recognized but also deemed unhelpful in this context. The suggestion to start working with my hands – making – was largely appealing and slightly worrying.
>
> (Patrik, weekly reflection, week 3)

Patrik eventually abandoned the brooch idea. Instead, he chose the indoor–outdoor idea and a collage he had made. The collage, shown in Figure 6, crystallized his experience of the contrasts in the environment during the hike in Lapland: the warm interior of the cottage and the harsh cold outside.

During the meeting, the teacher told Patrik that a kaleidoscope would capture the different parts and experiences of the trip. Apparently, this passing comment created an association with his collage and helped him to find a new path in his process. Patrik made his first kaleidoscope in the same week (week 3, see Figure 7). Creating a kaleidoscope and experimenting with it made it possible for him to think through making and step into the seeing-moving-seeing process. For example, Ingold (2013: 31) conceives the act of making as an event in which the maker couples their movements and gestures



*Figure 6: Patrik's source of inspiration – a collage of two extremes in Lapland. Photograph by Patrik.*
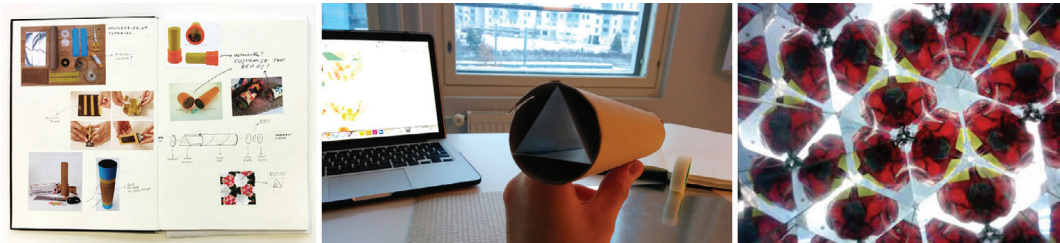


*Figure 7: Patrik's weekly diary-making of the first kaleidoscope. Photographs by Patrik.*

with the becoming of their materials. In this process, the form of the work is not known beforehand and forced upon the material; instead, it is revealed as making continues. Therefore, thinking happens through making (see also Mäkelä and Aktaş 2022: 18; Bolt 2007; Kontturi 2018).

The process of trying things out and seeing the results was very concrete. However, Patrik explained that by experimenting, his idea deepened in a very subtle way, which was different from focused decision-making. To his surprise, Patrik had smoothly switched from the traditional design approach to a more practice-led approach when he decided to let go and experiment freely. He reflected on this change thus:

> It's quite an unusual thing for me to realize the meaning of the proto-type only after having made one; the process is usually thinking then doing. In this case, the doing helped create and then better focus on the idea. Afterwards, the rest followed, with the same ideation process.
>
> (Patrik, weekly reflection, week 4)

Patrik wanted to extend the idea beyond the prototype. He visited exhibitions and ended up trying out different types of content inside the kaleidoscope. In the meeting during week 5, he showed the group the results of these experiments – fragmented images made with different kinds of content in a kaleidoscope. These images represented another reality for him. He connected this thought to the Tuija Lindström exhibition he visited and its artworks, where the plants became, as Patrik wrote, 'something even more beautiful than the original plant'. This led him to think about mundane things and how to use them to express another reality. This idea was extended when an important turning point occurred, and his understanding reached a point that combined all the elements of the process into his final artwork.

Patrik conceived the kaleidoscope as an escape from the real world and as something that has the power to change our point of view. He ended up with the metaphor of 'wonderful stuff' as well as a video of human daily routines that produce trash. In the exhibition, visitors could try out the kaleidoscopes and see how trash produced beautiful images (Figure 8). Together, the video and kaleidoscopes created a message that contrasted the significant and the insignificant in human life.

Patrik's process illustrated many elements of idea development, especially the association of the source of inspiration with the kaleidoscope and the combination of different sources (artwork, kaleidoscope and another reality), which led to a novel result.



*Figure 8: Trying out the kaleidoscopes at the exhibition and the 'wonderful stuff' they created. Photographs by Olivia and Patrik.*

### Material-led conceptual inquiry

Roosa's and Olivia's processes highlight the role of information gathering and the use of sources as a basis for conceptual inquiry. Roosa and Olivia analysed informational sources or documents as part of their processes, which allowed them to see conceptual patterns and connections in their experiences. At the beginning of their creative processes, both students created open and abstract concepts. Their processes included studying the concepts and constraining idea spaces by reflecting on the acquired knowledge. Below, we follow Roosa's process.

Roosa's most meaningful events and memories from the trip to Lapland were the traditional Finnish rag rugs, a Sámi lady's visit and her joiks (traditional songs), and a vision of a creature dipping its tail (see Figure 9), which she encountered during the shamanic ritual:

> Soon I saw a bright light, which grew stronger, and I came out to Himalaya-like mountains. It was really sunny and bright outside. I had a feeling that I would find a bear. And I did. It was black and big. We just gazed at each other and I tried to ask him some questions. No answers. Suddenly, I heard a neigh. I started to run in the direction of the neigh and quickly reached a seal pup-like creature that had the head of My Little Pony, a tail, and features of Casper the Friendly Ghost. When I asked the creature what the subject of my upcoming thesis work could be, it dipped its tail in the lake. Repeatedly.
>
> (Roosa, final reflection)

In the meeting for week 3, the group was very interested in the dipping vision and there was a lively discussion about the liquid and its nature and purpose. Roosa decided to develop the dipping vision, about which she had a clear idea:



*Figure 9: Sketches made after the ritual: the creature 'Casper Little Pony', which dipped its tail, and the idea of dipping things. Images by Roosa.*

> My idea was based on the thought that design is often presented in the media as something that can be added at the end of product development. That design is a tag that can be glued on or a layer to make the outcome prettier. Designing requires some creativity and a lot of work, but what if the amount of creativity could easily be increased? If one could dip things in creativity, what would happen then?
>
> (Roosa, weekly reflection, week 3)

One of the teachers provided some sources to look for, while the other mentioned food design. Roosa's key idea began to contain all its essential elements for the deeper idea-structuring process. During the same week, after looking for sources, she thought that she wanted to concentrate on the multimodal essence of food, which would include taste, colour, texture and smell. She tried dipping food in candle wax, but it did not work. She considered presenting the 'creativity ingredients' as a part of her work. While thinking about the visual and material side of this work, she also unwrapped the concept of creativity by, for example, watching informative talks and analysing their meaning.

For the week 4 meeting, she brought the examples from food design that she had found. The discussion revolved around the meaning of food in visual and artistic works. This discussion reinforced her earlier thought that she wanted to respect food and have a wider meaning behind her work. Her seeing-moving-seeing process started during week 4. It involved studying different sources of information and inspiration, reflecting on these in terms of her subjective understanding of her creativity, and systematically experimenting with different food-related liquids to produce the right colour and viscosity, thus illustrating her creativity.

During weeks 4 and 5, she merged different parts of her idea into a final concept. Individual tutoring had clarified for her that the result would be some sort of pixel art made from, for example, plastic bag squares, which would form a kind of fruit. Eventually, she rejected the plastic bags because the element of dipping was missing from them (Figure 10). However, pixel art motivated her since it had a connection to her job as a game designer.

During the same weeks, Roosa developed the idea of fruit and took it forward. She was able to define her idea when she analysed the fruit in parts, as the teacher suggested. She imagined the fruit in a very material and embodied way – what the composition of the seed (of creativity) would be, and how it would look and taste.

For her final piece, which involved presenting the fruit as a pixel artwork, she tried out dried bread, cutting it into squares. However, she decided to use square crackers due to time restrictions. In week 6, she was still seeking the final form of the artwork. In the meeting for that week, the teacher mentioned Kaarina Kaikkonen, an artist who makes non-figurative collages with clothes. Roosa thought that as a backup plan she could use crackers as a colour and material study. She thus started to study pixel art to find her style. The following week, she showed the group a picture of 600 crackers that she had dipped into different candy colours without any clear plan, only following her mood. She was visibly relieved and was able to let the making process lead her; she was no longer worried about what the result would be – she would just trust the process. In the exhibition, she presented her pixelated artwork (Figure 11).

During her creative journey, Roosa used sources and experimentation to analytically consider new constraining features. Each time she found a new

*Figure 10: Sharing the results of experimenting with fruits. Photograph by Maarit Mäkelä.*



*Figure 11: Roosa constructing her piece at the course exhibition. Photograph by Krista Kosonen.*

feature – for example, pixel art – she would develop it by searching for more sources of inspiration and information connected to it. Furthermore, she was also ready to try out new materials that would enable her to lead her creative process in a meaningful direction.

## DISCUSSION

This article presented an analysis of material-led practices during the DEE course. While the course featured a highly constrained learning environment, supported by weekly meetings and tasks, it emphasized the creative process and making rather than the effective development of the design concept. Because of the chosen pedagogical approach, the learning environment pushed the students into a deep research mode. This mode included finding one's constraints and frame for the task, reflecting individually and with others on the task, and relying on the group, peers, teachers and experimentation during the process.

Through our analysis, we were able to trace and interpret how students emphasized practices, but also how the key idea and related goals evolved in the creative process. We formulated and typified this evidence into three main approaches: (1) identity building, (2) overcoming challenges in idea development and (3) material-led conceptual inquiry.

The results illustrate how unstructured, explorative making influenced idea development. Making informed this process by providing cues and leading to new understandings. The exploration was a reflective conversation between maker and material. The students' processes demonstrate the potential that different practices and experimentation have for decision-making. For example, letting go of conscious efforts to create ready-made concepts in favour of experimenting, allowing this practice to guide the creative process, led to important turning points. However, evolving ideas were connected to finding new guiding sources of inspiration or information, refining or elaborating particular features of the new sources, and linking the features of different sources to ideas (e.g. metaphors), especially towards the end of the course. This process might extend the key idea, or change it, but the result would always consist of a variety of meanings acquired in the ebb and flow of the journey.

These results can help us, as educators, to guide students to prolong their process of idea development in a more focused manner in other contexts. The study encourages us to understand the role of practices with different goals and approaches. It also reveals the central role of interaction and social support. Turning points (e.g. the selection of the key idea), starting to experiment and finding the final meaning and content for the idea were linked to interactions with others, who could be humans (e.g. teacher, classmate, friend) or non-humans. In the study, we focused on a non-human participant in the form of the explored material.

Not all the participating students were familiar with hands-on activities used for decision-making and constraining key ideas. For a newcomer, each transition in the creative process – from idea generation and development to making and finalizing the artwork – presented a potential boundary to be crossed. Although experience can be a crucial resource for learning, past experiences can also affect how learners view, evaluate and participate in the new learning context. One feels comfortable with experiences that are congruent with the past. If the experience differs too much from the past, some learners might struggle with the lack of fit to old patterns. The new learning context might challenge existing mental models and require the learner to develop

new ones (Belzer 2004). Therefore, it is not surprising to us that in a course such as DEE, not all the students are necessarily eager to start exploring or interacting. A student's previous experience in conceptual design might dominate the approach to the task, or an individual process might seem difficult after previously learnt group tasks. Furthermore, the students' current life situation may affect their attitude towards the educational experience.

In particular, emotions are intrinsically linked to learning as they control the students' attention and motivation; they modify their education strategies and affect their self-regulation for learning. Emotions are a vital part of a student's identity, personality development and psychological and physical health (Pekrun 2014: 6). In the case of new and non-routine tasks, Pekrun mentions feelings triggered by cognitive problems, such as surprise for a new task, related curiosity, confusion and frustration about obstacles. But cognitive problems also have the potential to generate positive emotions when the task is solved (Pekrun 2014: 8).

Becoming a creative professional is a journey full of pressures. It entails finding a certain approach that stands out in the field and specific methods that can be key assets. The more artistic is the work, the more individual expression and style are essential (Kosonen 2018: 1). Learning creative expression happens through practice and experience; it has a tacit dimension that makes what needs to be learnt and how often uncertain (Carabine 2013).

The task introduced in the DEE course might have uncovered personal insecurities and generated uncertainty regarding such an open-ended process. Bearing this kind of uncertainty in a creative process is something that is learnt in practice and over time. The DEE course was one opportunity to do this, but it was evident that personal and emotional issues created challenges for some of the students. Regardless, or perhaps because, of this, we believe there is a need to study the learning experience and its emotions in this educational context. We need to increase awareness of the psychological capacities that make it possible to work with uncertainty and not-knowing (Carabine 2013).

We believe that providing design students with an experience that encourages and coaches them to work with personal and emotional issues will provide valuable insights into how they can manage their creative processes. Doing so can also be an opportunity to understand what it might mean to invest time in a profound process where a wide variety of design skills and personal identity are used and become entangled. We believe this is needed for future designers, who will face extremely complex issues (St. Pierre 2019) that need to be both solved and lived with.

## ACKNOWLEDGEMENTS

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**SUGGESTED CITATION**

**CONTRIBUTOR DETAILS**

Tarja-Kaarina Laamanen, Ph.D., has background as a maker, researcher and teacher. Her focus as a researcher is in materiality of designing, design ideation and related representations, design process as well as design education in a sociocultural framework.

Contact: Runoilijanpolku 2A, 00650 Helsinki, Finland.
E-mail: tklaaman@gmail.com

https://orcid.org/0000-0003-2885-8968

Maarit Mäkelä is an associate professor at the Aalto University School of Arts, Design and Architecture, Finland, where she is leading the EMPIRICA research group and contemporary design master's programme. Her own creative practice is located in the context of contemporary ceramics. Her research interest lies in creative processes – in particular, how reflective diaries and visual documentation can be utilized for capturing the personal process. She is initiator of the *Art of Research* conference and co-editor of the anthologies *The Art of Research: Research Practices in Art and Design* (University of Art and Design, 2006) and *Art of Research II: Process, Results and Contribution* (Aalto University, School of Arts, Design and Architecture, 2012).

Contact: Department of Design, Otaniementie 14, 02150 Espoo, Finland.
E-mail: maarit.makela@aalto.fi

https://orcid.org/0000-0003-3102-5262

Pirita Seitamaa-Hakkarainen (Ph.D.) is a professor of craft science at the University of Helsinki. Her research interests focus on design processes and facilitation of collaborative design through technology-enhanced learning.

Contact: Faculty of Educational Sciences, Siltavuorenpenger 10, Box 00014 University of Helsinki, Finland.
E-mail: pirita.seitamaa-hakkarainen@helsinki.fi

ⓘ http://orcid.org/0000-0001-7493-7435