https://doi.org/10.7577/formakademisk.5389

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From not yet knowing to achieving directionality

On the roles of materiality in multi-sited, interdisciplinary studio settings

ABSTRACT
This paper investigates the active role of materials in shaping ideation processes during interdisciplinary studio-based collaborations. Using ethnographic data collected from a graduate-level course conducted across multiple studio settings, we analysed how materiality facilitates interactions between students and studio instructors meeting for the first time when creative ideas are not yet fully formed and knowledge of unfamiliar materials is not yet embodied. The findings elucidate how certain materials are central to (1) demonstrating, (2) understanding, (3) sharing, (4) explaining, (5) generating and (6) challenging aspects related to ideation processes within such interactions. We conclude this work by emphasising the need for further research that focuses on material mediation in the context of student–instructor relationships.

Keywords:
Materials, interdisciplinary collaboration, ideation, interaction, studio teaching.

INTRODUCTION

The hybridisation of traditional and digital technologies is rapidly transforming teaching and learning practices in contemporary studio education. Further enhanced by the cross-pollination of disciplines such as craft, design and engineering, this transformation increasingly provides students with access to new creative environments that foster unanticipated forms of studio-based collaborations. However, creative projects that occur in multiple studio settings demand that students navigate the uncertainties of dealing with unfamiliar knowledge, spaces and materials (e.g. Salolainen et al., 2017). Thus, the current paper examines the beginning of a multi-sited, collaborative studio project that focuses on the early stage of the process—when critical decisions are made to provide creative ideas with a sense of directionality.

Using a multi-sited ethnographic approach, we followed a group of three experimental textile-making students across multiple studio environments. The students needed to explain their ideas to studio instructors, who had no preconceptions of the project they had envisioned. In particular, the students were briefed to work in teams to design and produce an e-textile that combined engineering and textile making—a task they achieved by creating a physical prototype via the handling of unfamiliar materials. We then analysed (1) how materials prompted interactions between students and studio instructors who were meeting for the first time and (2) how their interactions facilitated ideation processes in the early phases of the creative project—a point in time when everything was possible yet still uncertain.

THEORETICAL FOUNDATION

Designing can be understood as a complex problem-solving process involving the exploration and interpretation of ideas, which can be materialised through iterative cycles of sketching, prototyping and making (Cross, 2006). Ideation, the critical early stage of the process (Johnson, 2005), requires students to navigate the uncertainties of working with ideas that are not yet fully formed. Tanggaard (2015) notes that ideation in design includes the interactions between ideas, instruments, socio-material environments and embodied skills involved in creative externalisation, material exploration and prototyping.

Traditional design and craft education has relied on a well-established studio pedagogy based on the principles of 'learning-by-doing' and 'reflection-in-action' (Schön, 1987), which are practiced through open-ended design tasks (Cennamo & Brandt, 2012). In studio teaching, course teachers and studio instructors assist students by supporting them with directive guidance, such as resolving constraints and highlighting resources (Sheridan et al., 2022). The open-ended tasks may involve interdisciplinary collaborations that allow students to approach the project from a holistic perspective (McMahon & Bhamra, 2016). In collaborative design settings, team members actively participate in, for example, communicating ideas, identifying constraints, making joint decisions and generating design artefacts (Lahti et al., 2016). However, when these projects occur in interdisciplinary settings, disciplinary boundaries can make communication more difficult (Cho et al., 2015), thus revealing divergent approaches to working with materials.

The present paper extends prior work on collaborative studio practices by examining the active role of materials in shaping ideation processes and bridging knowledge gaps caused by disciplinary barriers. Previous studies have addressed the beneficial role of materials in collaborative design work (e.g. Heiss, 2020), and we contribute to this research stream by stressing that studio pedagogy is not solely dependent on discursive capabilities, such as conceptualisation, verbalisation or the explicit articulation of ideas, but is also largely based on the tacit knowledge acquired through direct engagement with materials (Vega et al., 2021). In this context, working with materials provides students with a tangible means to transition from a phase of uncertainty to one of directionality. Our focus is on the stage of the creative process when such tacit knowledge is still not fully formed or embodied, most particularly in situations wherein manipulating unfamiliar materials or lacking specific skills does not hinder the formation of novel ideas. Scharmer characterises these situations as moments of 'not-yet-embodied knowledge' (2000, p. 36), indicating that whereas embodied knowledge concerns the ability to make things, not-yet-embodied knowledge concerns the potentiality of developing such an ability.

METHODS

Setting and participants

Our study is based on multi-sited ethnographic data collected during a six-week period of a graduate-level university course Art and Mechatronics. The course is a part of a larger study module Experimental Textile Design, which is offered to freshmen students enrolled in a Fashion, Clothing and Textiles programme. Art and Mechatronics provides art students with a basic understanding of the novel possibilities of combining technology with textile design practices through a collaborative approach. We followed a team of three students, who were tasked to create an e-textile and develop a potential application for it by combining intuitive material exploration and engineering. In the context of the course assignment, the understanding of textile materials extended beyond 'traditional textile materials' (e.g. fabrics and yarns). For example, silicone and metal were used to re-interpret textile products. The team first created a conceptual idea for their project, followed by visits to multiple studios to enhance their idea towards a more concrete experimentation with materials and techniques, which eventually led to the creation of a unique artefact.

Data acquisition and analysis

The data used in the analysis were gathered from three studio locations. The first author followed the team of students and was present at all locations to make ethnographic notes and take close-up photographs. The work and interactions that occurred in all three studios (metal workshop, mechatronics studio and surface studio) were captured using one or two video cameras and microphones. The metal workshop provides tools, materials and personnel for processing metal. In the mechatronics studio, the students can, for example, do programming and soldering. In the surface studio, the students can perform multi-material surface work, such as painting, gluing and silicone casting. Altogether, our data consisted of approximately 14 hours of video materials, 260 photographs and observational notes. From this dataset, we selected clips that included activities from the very beginning of the team's project. Thus, the data selected for our analysis consisted of 90 photographs as well as 110 minutes of video recordings from the metal workshop, 51 minutes from the mechatronics studio and 81 minutes from the surface studio.

Our analysis of the video data resembled qualitative thematic analysis (see, e.g. Braun & Clarke, 2012), in accordance with the elements of multimodal group interaction analysis (e.g., Jeong, 2013). Following Braun and Clarke's (2012) ideas, we conducted the analysis from the bottom up, without any pre-categorisation. The unit of interaction was group ideation. In particular, we went through the data iteratively for preliminary notions and proceeded with several cycles of analysis. First, we identified the team's initial ideas for their project to understand their creative process as they began their visits to the studios. This provided us with a basis for analysing the evolution of the team's ideas. We observed two initial ideas: a) a bendy torus shape created with metal wire with LED lights and b) a prototype of a silicone galosh with LED lights. Next, we identified moments of interaction from the video data (Figure 1) and generated the main themes to describe the context of the interactions. These themes included, amongst others, the students introducing themselves to one another, the studio instructors giving tours around the studios, the students gathering around a working tool and the team asking questions or giving feedback.

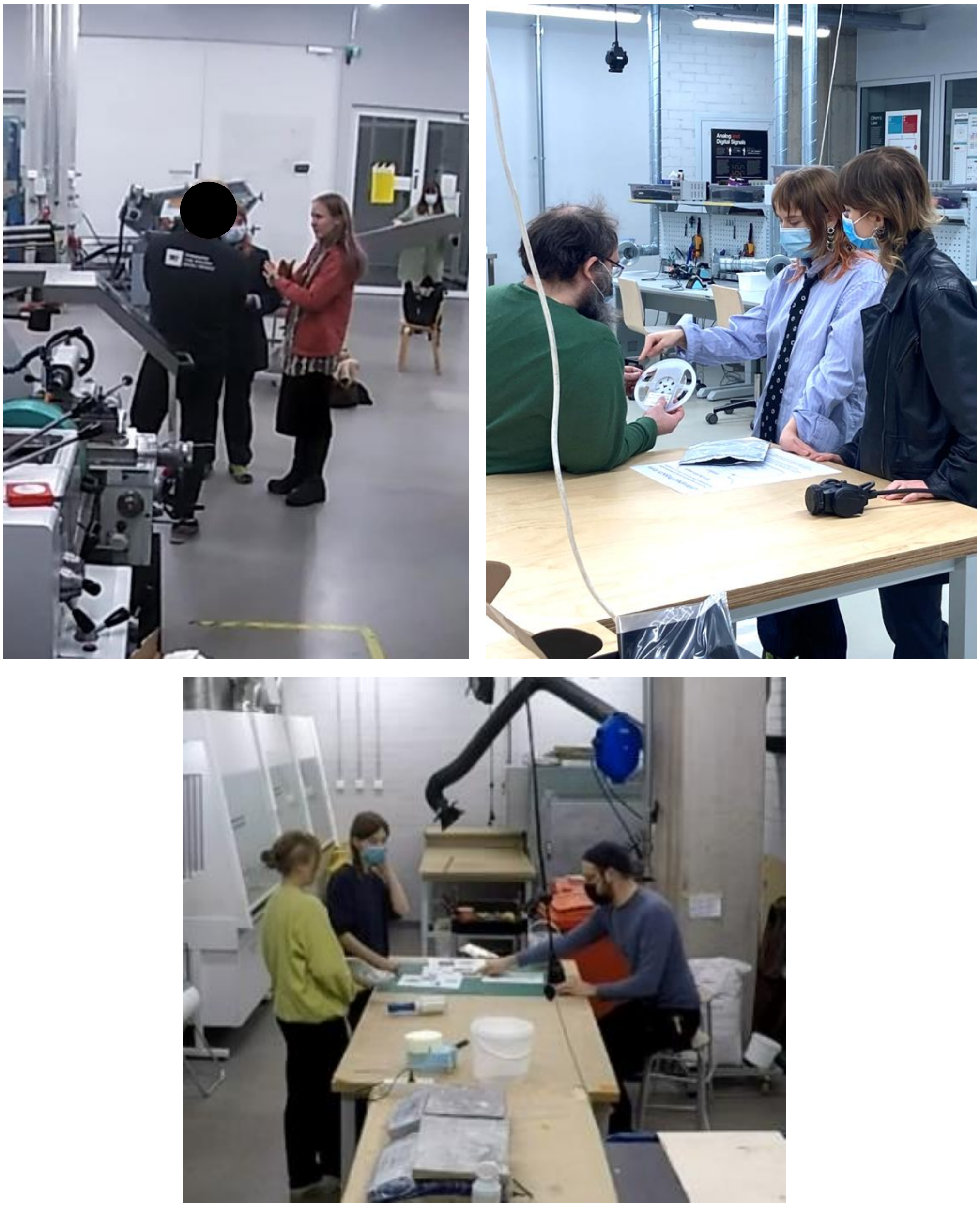

FIGURE 1. Moments of interaction at the metal workshop (top left), the mechatronics studio (top right) and the surface studio (bottom)

To generate the second-level themes on group interaction, which also included materials, we revisited the selected moments and reflected on the initial themes one by one. This time, however, we zoomed in more closely into the materials, such as the students showing their mood board to the studio instructor, or the instructor showing certain tools to the students, handling materials in front of the students or referring to a specific material. We focused on identifying and creating descriptive themes regarding how the role of materials was shaped in relation to a particular context of the interaction, such as when a mood board was shown to the instructor to demonstrate visual aspects of the initial project idea. Overall, we identified six roles of materiality as facilitators of interactions and group ideation (Table 1).

TABLE 1. The identified roles of materials as interaction and ideation facilitators.

The roles of materials	Demonstrate	Understand	Share	Explain	Generate	Challenge
For the students	Visual aspects Material qualities	Possibilities and restrictions of a specific material and the space	Ideas Questions	Specific functions Qualities of the desired outcome	Constraints	Ideas Conceptions Previous experiences
For the instructor	Techniques and activities Qualities of a specific material/tool	Students' ideas Students' previous knowledge and conceptions The desired outcome	Expert knowledge Ideas	Qualities of a material or a tool Constraints and restrictions		Conceptions Previous experiences

As a result, we were able to clarify and follow the identification of the kinds of paths for the project ideas provided by the interactions in each studio (Table 2).

FINDINGS

The interdisciplinary project required specific material actors to facilitate the exchange of thoughts that, in turn, would enable a common understanding of the project between the student team and the studio instructors. The team's project started with the metal workshop. First, the students did not bring any concrete material with them. Even if they described the materials and mimicked the nature of their ideas to the instructor, it was difficult for them to transfer the ideas to the instructor, as exemplified in the excerpt below:

> *Student 1:* How can one create a spring, like how to twirl metal wire?
> *Instructor:* We are poorly stocked with metal wire? How thick would that be [referring to the wire that the students described]?
> *Student 2:* Well…kind of thin. I guess we had an idea that we could sort of knit these, so…
> *Instructor*: OK, yeah, but that is not like a 4-mm wire [referring to the wire that students would have].
> *Student 1:* So, like as flexible as possible [the end result and the material]…
> *Instructor:* …Well, kind of, the thinner the better. Then, with these manually operated [referring to tools] bigger machines, it can be difficult to do bending and what not with a thinner material. But it would be easier to sort of look and test if you had the material with you.

The materials certainly helped make the idea more feasible to the instructors. The students had a limited selection of materials with them: mood boards, a metal wire and a shoe last. The presentation of mood boards (Figure 2) allowed the students to visually share, demonstrate and explain aspects and qualities related to their ideas (Table 1).

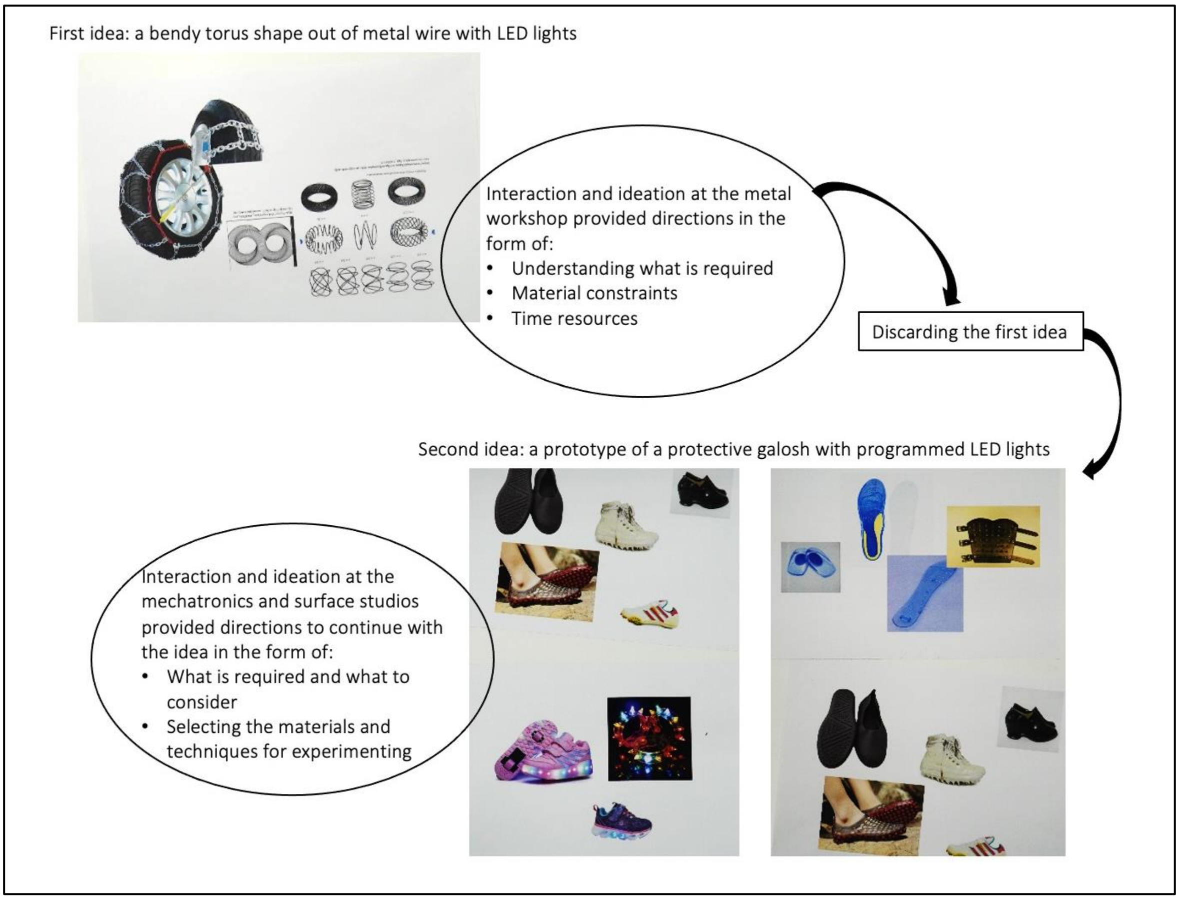

FIGURE 2. The evolution of ideas up to the final version during the first interactional moments in the studios.

In addition, the students used the metal wire and images to articulate to the instructors specific functionalities, such as blinking lights encircling a shoe, and to explain their desired outcome. This, in turn, aided the instructor in understanding what was required of him and what topics were to be addressed at this point in the project (Table 1).

Furthermore, the students referred to various materials to ask questions about design techniques and aesthetic features. In addition to the materials the students brought, the studio instructors introduced various other materials and available tools into the discussions. Thus, through materially stimulated reflections, both the students and the instructors questioned their pre-conceived notions and explored the capabilities of the materials. For example, they discussed whether the thin metal wire could be bent into a torus shape or whether silicone could be shaped into a galosh. Thus, the materials facilitated the sharing of ideas and questions, simultaneously challenging the participants' initial ideas, conceptions and previous experiences (Table 1).

For the instructors, materials also played a crucial role in sharing their expertise and craftsmanship. By demonstrating and explaining material usage while reflecting on the team's ideas and images, the instructors were able to provide valuable knowledge about the feasible directions, techniques and required materials for the project at hand. They also considered critical factors, such as time and resource availability. The exploration of different tools and materials was crucial for the students' projects, as it enhanced their understanding of the possibilities and limitations while providing important directional constraints. Altogether, materiality in the form of physical and imagined materials, tools, images and space had a central role in mediating interactions among studio instructors and students. Furthermore, apart from facilitating interactions, the visit to the studios also provided direction for the team's ideas, crystallising them with specific material, aesthetic and technical considerations (Table 2).

TABLE 2. Directions for ideation through materially facilitated interactions during the first visits to the studios.

Direction provided through materially facilitated interaction	Material	Technical	Aesthetic	Overall project idea	Process oganizing
Metal workshop	Directed to consider other alternative materials, e.g. silicone	Directed to re-evaluate their initial plans to create a bendy torus with blinking lights		Discarding the idea of a torus with another idea of a silicone galosh	How to be prepared for the visits to the following studios
Mechatronics studio	Confirmed the possibility of using LED lights and wires	Confirmed the idea of wiring and programming The possibility of creating in this studio and with the help of the studio instructor	Directed the ideation of how the galosh would look like with lights and wires	Clarifying the galosh idea to proceed to experimentation and production	What to take into account as the work progresses (i.e. what, how and when)
Surface studio	Confirmed the material to be used: silicone	What to consider with silicone and wirings	The surface of the galosh design	Clarifying the galosh idea to proceed to experimentation and production	What to consider as the work progresses (i.e. what, how and when)

Ultimately, the materially facilitated interaction directed the overall project idea and the way in which the team organised the process (Table 2). As an example, during the visit to the metal workshop, the team's idea centred on a torus-shaped metal object with programmed blinking LED lights. However, due to the time, skills and material constraints identified during the interaction in the metal workshop, the students decided to create a prototype galosh made of silicone with programmed LED lights.

The instructors in these studios raised questions about the idea based on the inspirational images presented by the student group (Figure 2). This enquiry forced the students to interpret, re-evaluate and articulate their ideas more precisely. The materials presented by the instructors during these interactions also guided the students in selecting which ideas to pursue further. For example, the mechatronics instructor introduced different LED lights, provided technical insights, addressed the students' questions and contributed to their decision to incorporate LED lights into their project.

In summary, the visits to different studios and their interactions with the materials, studio instructors and inspirational images played a vital role in shaping and refining the team's idea, allowing the students to make informed design decisions.

DISCUSSION

This study examined the very beginning of an interdisciplinary project that occurred in multiple studio settings. Analysing the interactions within the three studios provided insights into the role of materials, as the students and studio instructors attempted not only to explain and describe their ideas but also to work together in ways that benefitted the students' project. With material facilitations, the students and instructors were able to come to joint conclusions, better understand what the project was about and determine which ideas to consider further. Despite the team entering the studio with a problem and not much experience or knowledge related to these specific studios and materials, they were able to present their ideas so that the instructors could understand them and provide additional information. In this respect, we emphasise that the project materials facilitated communication and contributed to the development of a common understanding between disciplines and professional levels, which in turn, helped the students set the direction for their project. Primarily, we argue that the materials served as mediators at six levels of interaction: demonstrating, understanding, sharing, explaining, generating and challenging, thereby providing benefitting anchors and reference points (cf. Heiss, 2020) through which the students and the instructors can exchange knowledge and ask direction-oriented questions.

Based on our findings, MA-level students are skilled enough to make directional decisions based on demonstrative introductions to materials and techniques already in the ideation phase of interdisciplinary projects of this kind. We argue that pedagogical situations like this make an exemplary case of not-yet-embodied knowledge at play (Scharmer, 2000), thus offering an appropriate empirical setting to examine how students develop a sense of directionality for projects that require solving ill-defined problems. Although the team did not yet proceed to their experiment with unknown materials, they were able to envision possibilities and constraints, as well discard the idea of the metal torus. Therefore, our findings support the view that more experienced designers possess a larger asset of embodied knowledge of materials, enabling them to conduct more precise ideation processes (Groth, 2017, p. 61), even when facing the task of working with unfamiliar materials and techniques.

Overall, the study warrants critical attention to the role of material facilitation in the specific context of student–instructor studio interaction, thus highlighting the importance of practical (material) education. Given the limited space, our study focused on a fraction of a complex and explorative project with a small sample. Although rich, multi-sited ethnographic data were collected, the present study did not include any reflective thoughts from the study participants. Thus, future studies should examine materially facilitated interactions within the subsequent stages of students' projects, further complemented by post-project interviews. In this way, the *why's* and *why not's* of both the students and instructors during collaborative projects can be thoroughly analysed.

ACKNOWLEDGEMENTS

This work was supported by the Academy of Finland (Project Nos. 331778 and 331763) and the Ella and Georg Ehrnrooth Foundation.

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