Salolainen, Maarit; Partanen, Jouni; Moslemian, Oldouz; Suorlahti, Eeva; Kiviluoma, Panu; Niinimäki, Kirsi

Crossing over Boundaries through Experimental Pedagogy

Published in:
REDO

Published: 31/05/2017

Document Version
Publisher's PDF, also known as Version of record

Please cite the original version:
Salolainen, M., Partanen, J., Moslemian, O., Suorlahti, E., Kiviluoma, P., & Niinimäki, K. (2017). Crossing over Boundaries through Experimental Pedagogy. In A. L. Bang, M. Mikkelsen, & A. Flinck (Eds.), *REDO: Cumulus Conference Proceedings* (pp. 156-168). Design School Kolding.

Crossing over Boundaries through Experimental Pedagogy

Maarit Salolainen[a]*, Jouni Partanen[b], Oldouz Moslemian[a], Eeva Suorlahti[a], Panu Kiviluoma[b], Kirsi Niinimäki[a]

[a]Aalto University, School of Arts, Design and Architecture
[b]Aalto University, School of Engineering
*Corresponding author e-mail: maarit.salolainen@aalto.fi

Abstract: This paper describes an experimental teaching platform, which aims to cross over boundaries to educate future designers and engineers. The Experimental Textile Design module (ETD) is a multidisciplinary set of courses developed under Fashion, Clothing, and Textile Design program within School of Arts, Design and Architecture in cooperation with The School of Engineering at Aalto University. Through redoing design pedagogy by opening the world of engineering to design students and especially by exposing design methodologies and the visual research processes to engineering students, we can help collaborative teams to redo the future.

Keywords: Experimental teaching, Multidisciplinary, Collaboration, Textile design

1. Context and objectives

The very essence of textile design lies in cooperation and multidisciplinary approach. Textiles are commonly implemented as material or component with variety of purposes in clothing, interiors, medicine, architecture and other technical applications. Educating individuals with abilities to work in multidisciplinary environments with “hybrid” skills and knowledge, capable of rethinking design futures, should be encouraged.

The Experimental Textile Design module (ETD) is a multidisciplinary set of courses developed under Fashion, Clothing, and Textile Design program within School of Arts, Design, and Architecture in cooperation with The School of Engineering at Aalto University. The main objective of this module is to provide a platform to share knowledge and open the realm of textiles to a broader audience. It encourages students to develop ideas among peers from different backgrounds through collaboration and implement their skills into other disciplines. The module provides an opportunity for design and engineering students to explore experimental design approaches and fabrication processes. New and innovative products can result from interdisciplinary projects, in which textile logics and construction methods are applied to non-textile materials or inversely innovative textile compositions can emerge from integration of new technologies.

2. Structure and Teaching Methods

The ETD module is offered to first year master's students during the first semester. In 2016, this module involved 28 participants with various backgrounds, including 22 students from the School of Arts, Design and Architecture and 6 students from the School of Engineering (Table 1).

Table 1. Provides information on participating students and their study backgrounds.

Aalto University Schools	Program of Study	No. of students
School of Arts, Design, and Architecture	Textile Design	7
	Fashion Design	10
	Ceramics and Product Design	2
	Spatial Design	1
	Visual Culture and Contemporary Art	1
	Industrial Design	1
School of Engineering	Mechanical Engineering	4
	Engineering Physics	1
	Automation and Information Technology	1
		28 Total

Adaptive to students' skillsets and in accordance to their personal study plan, the structure of the ETD module allows the students to take part in a number of courses based on their necessities for knowledge and areas of interest (Table 2). This eight weeks intensive module is comprised of the following sections:

- Research and Concept Development course
- ARTsENG Collaborative project
- Photo and Presentation workshop
- Basic Studio Workshops: Knitting studio, Printing studio, and Woven Fabrics studio

Table 2. Presents the weekly schedule of the EDT module in which different sections of the course are studied.

Course Schedule	Research and Concept Development	Printed fabrics Studio	Knits and knitwear studio	Woven Fabrics studio	Photo and Presentation Workshop	ARTsENG Collaborative Project
Week 1						
Week 2						
Week 3						
Week 4						
Week 5						
Week 6						
Week 7						
Week 8						

This multidisciplinary module concentrates on teaching core skills of visual research, concept development, and textile techniques through learning-by-doing. The teaching methods are based on

constructivist teaching approaches in which the growth of knowledge is the result of individual constructions made by the learner's understanding (Piaget, 1973). Teachers guide each student to realise their projects through continuous and active dialogue with the learner in individual and group tutoring sessions (Bauersfeld, 1995; Rhodes and Bellamy, 1999).

This paper focuses on the multidisciplinary aspects of Research and Concept Development course, ARTsENG Collaborative project, and Photo and Presentation workshop sections of the EDT module.

3. Research and Concept Development Course

The multidisciplinary Research and Concept Development course establishes a platform for students to generate and solidify their concepts through visual communication and research. The course includes production of mood-boards, research books and experimental samples reflecting upon the students' visual research.

The Initial task is to develop two mood-boards through translation of notions into visual elements. The students first open a discourse within their topics, by drawing associations and references through variety of aspects such as cultural, social, political, economical, and emotional, as well as techniques, products, and materials. To further solidify the concepts, the students are acquainted with notions of mood, context and target to establish the themes and identify the objectives of the projects.

Figure 1. Examples of Visual Research Books developed by students. Left Image: Elina Äärelä, 2016 (photo credits: Elina Äärelä) – Right Image: Matilda Tuure, 2016 (photo credits: Eeva Suorlahti)

To translate their visual research into tangible objects, the students are encouraged to challenge conventional methods of production. Based on their individual ideas, wide range of techniques and materials are examined through explorative methods and continuous iterative approaches. This

experimental process allows the students to confront their initial ideas to materialisation. This material input provides insight and raises new questions that focus the project's direction.

The research books are the principal outcome of the visual research. They constitute an essential tool and are constructed by continuous collection of visual references and process works utilizing sketching, photography, writing, and other means of documentation. Documentation process is fundamental to record and illustrate both empirical and technical aspects of the experimentations. They crystallise the simultaneous iterations between the conceptual research and the material experimentations.

Through visual research, students extract images from their context and create new ideas. The abstraction of the images' content allows for versatile interpretation and is used as an inspirational tool for conceptualization and defining problems. While manipulating concepts and communicating ideas through images is familiar to design students, engineering students are often assigned a predefined problem to be solved. The open and explorative approach of visual research in generating the design objectives moves beyond the commonly linear and analytical engineering studies.

More importantly, the organization of thoughts through diverse visual media creates a communication "bridge" among engineering and design students that allows for crossing over field specific terminologies and mind-sets.

Figure 2. Experimental Sample Collection through Visual Research, Helmi Liikanen, 2016 (photo credits: Helmi Liikanen)

4. ARTsENG Collaborative Project

This multidisciplinary project establishes an innovative platform for students to merge technology and design and to explore unique ways of developing experimental textiles, materials, structures and fabrication methods. In 2016, 18 students formed 6 groups of 3: including 2 design and 1 engineering student.

Through lectures and presentations, the students are familiarised with subjects encompassing responsive and kinetic systems, hybrid or composite materials, as well as digital design and fabrication methods such as 3Dprinting and Laser Cutting. Student groups are formed through gaining perspective of their areas of interest and an active conversation surrounding the abovementioned topics.

Directly linked to the approaches of Research and Concept Development course, the students develop their project ideas in groups. The teams conduct their experimental work through iterative approaches and explorative prototyping. These prototypes operate as means for learning, communication, integration, and milestones (Ulrich & Eppinger, 1995). This method is linked to Constructive Design, which defines “a design research in which construction […] takes center place and becomes the key means in constructing knowledge” (Koskinen, et al., 2011, p.5). The method of research through design suits this course as the experiment and its outcomes are the key elements of producing the research question or the problem to be solved. This framework embodies perspectives of action and practice as the main elements of knowing (Schön, 1983; Johnson, 2007).

Figure 3. Material research process and prototyping in ARTsENG Collaborative Projects. Left Image: Atso-Kasper Costiander, experimentation in ceramics and electronics, 2016 (photo credits: Mikko Hoffren) – Right Image: Electronics prototyping for “Lucidum” Project, 2016 (photo credits: Carolina Forss)

As a complementary pedagogical approach aiming at further integration of disciplines, students from both design and engineering department are accountable to provide workshops relevant to their area of expertise and knowledge to their fellow students. These workshops include introduction to knitting, weaving, and printing techniques in textile design and workshops concerning 3D modelling, 3Dprinting and basic electronics in engineering. This knowledge construction enables students to transfer information and “acquire creativity, independence, self-confidence and key competencies,

such as the ability to work in teams, the ability to communicate, complex thinking […], and the ability to structure information and generate knowledge" (Grzega and Schöner, 2008, p.169).

This collaboration allows the students to familiarise themselves with experimental research methods, concept and product development approaches, and broader potential application areas of their knowledge beyond the conventions of their study realm.

5. Photo and Presentation Workshop

The concept of the Photo and Presentation workshop relates to marketing and branding of a developed product. Conducted as the final stage of the ETD module, in this workshop all students document the outcomes of their research, experimental samples, and collaborative projects. Students creatively produce powerful graphic content by means of set-ups, still-photos, videos and animations within the photography studios. Employing a hands-on approach, this workshop is used as a story telling tool for students to cohesively communicate the concepts and statements of their projects through high-quality and impactful visual presentations. This workshop highlights the importance and power of well-executed presentations to effectively communicate the outcome.

Figure 4. Photo and Presentation Workshop, Photo-Shoot session of student Kia Rossi, 2016 (photo credits: Eeva Suorlahti)

6. Case Examples of Experimental Samples

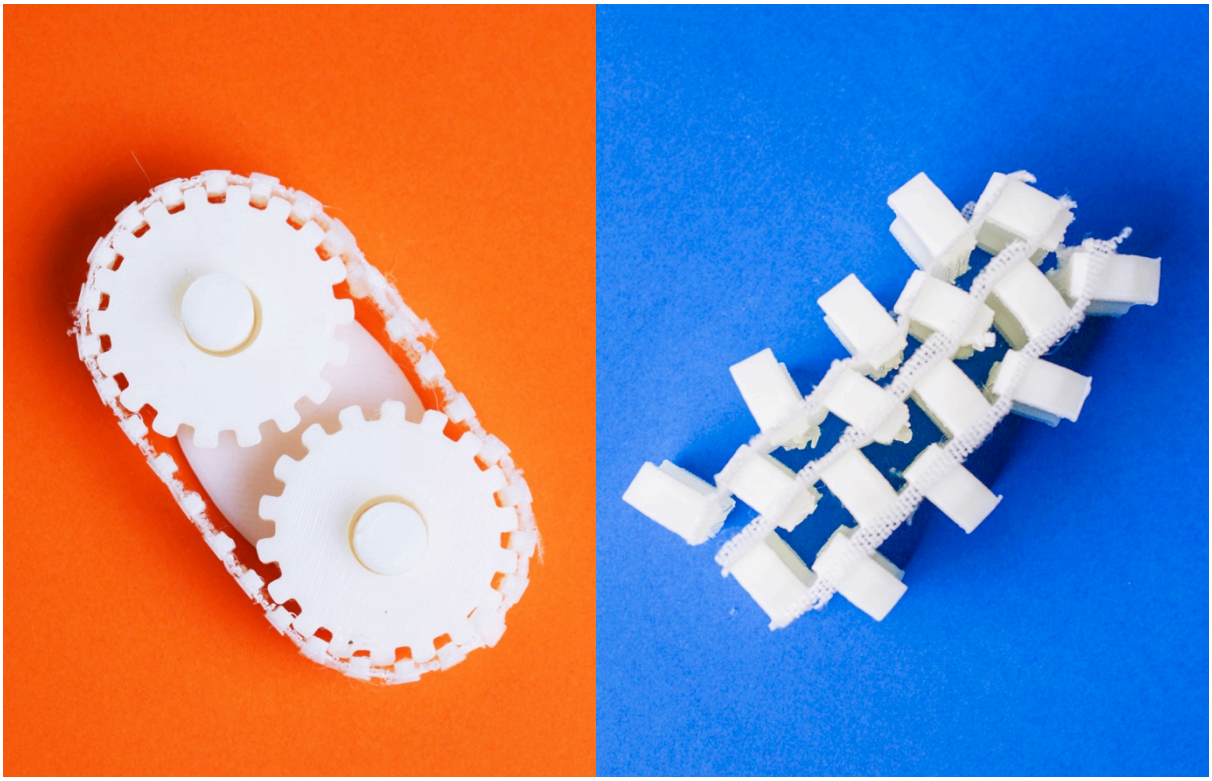


Figure 5. Challenging paradigms of one's field by exposure to another. Experimental Textile Sample,"Textile mechanics", Max Cedercreutz, 2016 (photo credits: Max Cedercreutz)

"Textile mechanics", developed by engineering student Max Cedercreutz, showcases an experimental sample project incorporating textiles as integral components within mechanical structures. Cedercreutz investigated opposing notions of rigidity and flexibility during his visual research. Experimenting with textile materials inspired him to design a series of prototypes by 3Dprinting on textiles, in which the latter behave as structural components and hinges in mechanical structures. Although the realm of 3Dprinting is familiar to most engineering students, this project demonstrates the potentials of collaboration and exposure of students to materials and methods of production from other disciplines.

Figure 6. Interaction with other fields sparkling inspiration and diffusing knowledge. Experimental Textile Sample,"High Tide", Matilda Tuure, 2016 (photo credits: Matilda Tuure)

Inspired by notions of viscosity and control, design student Matilda Tuure investigated the visual potentials of magnetic phenomena through experiments with ferrofluids and iron oxide. The "High Tide" project is an artistic exploration of movement and patterns generated with variety of magnetised viscous mixtures on different surfaces using magnets as a tool. Tuure took the initiative of communicating with the Aalto University, Applied Physics department, acquiring insight and material samples. This example demonstrates how the interaction with other fields of study can stimulate innovative approaches and instigate diffusion of knowledge.

7. Case Examples of ARTSsENG Collaboration

The "JMW-Textile" project was developed by design students Walter Götsch and Justus Kantakoski in cooperation with engineering student Masi Tammela. The main goal of the project consisted of exploring alternative methods of creating malleable textiles with inflexible materials. After research into geometries and modular compositions, samples were generated from numerous laser-cut wooden elements attached in diverse configurations. The project resulted in series of experimental prototypes that embody the functional and aesthetic characteristics of textiles, while presenting properties uncommon to traditional textiles.

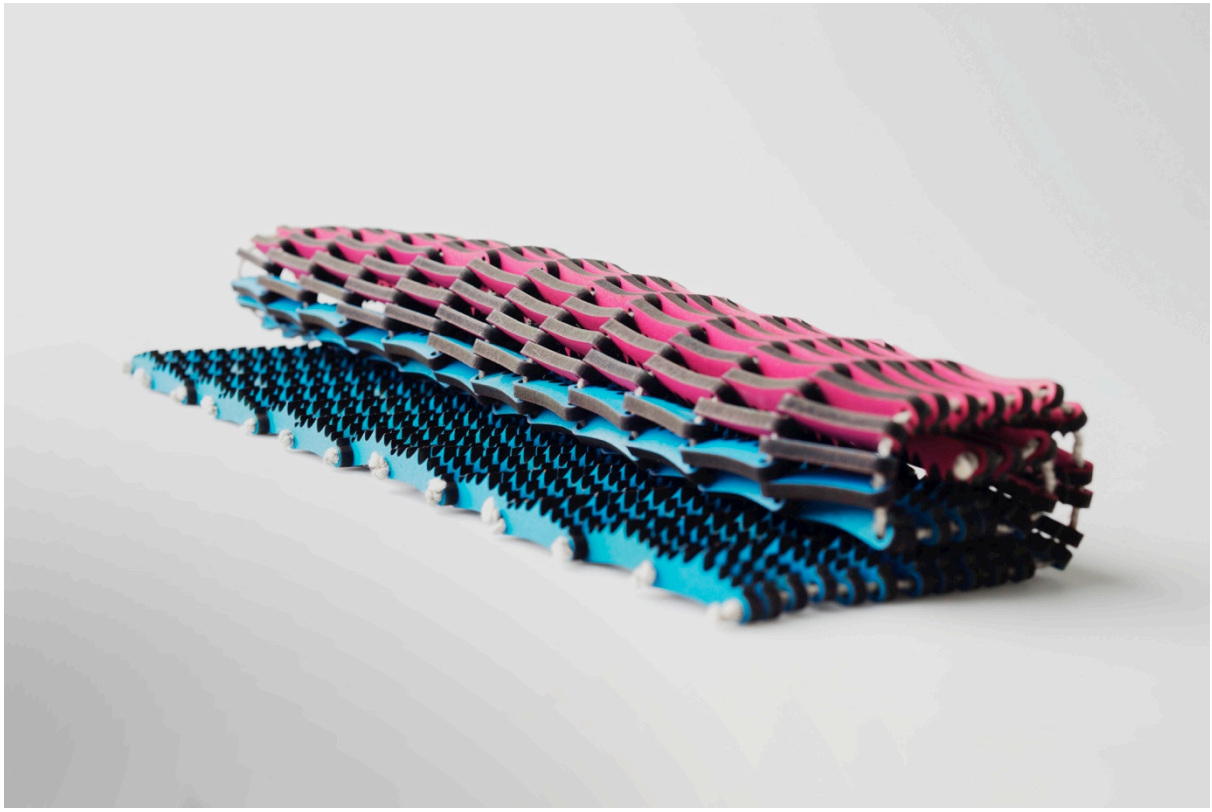


Figure 7. Unconventional textiles through integration of alternative fabrication technologies. ARTsENG Project, "JMW-Textile", Walter Götsch, Justus Kantakoski & Masi Tammela, 2016 (photo credits: Walter Götsch)

Figure 8. Innovative yet realistic product development. ARTsENG Project, "Lucidum", Carolina Forss and Helmi Liikanen & Teresia Borgman, 2016 (photo credits: Teresia Borgman)

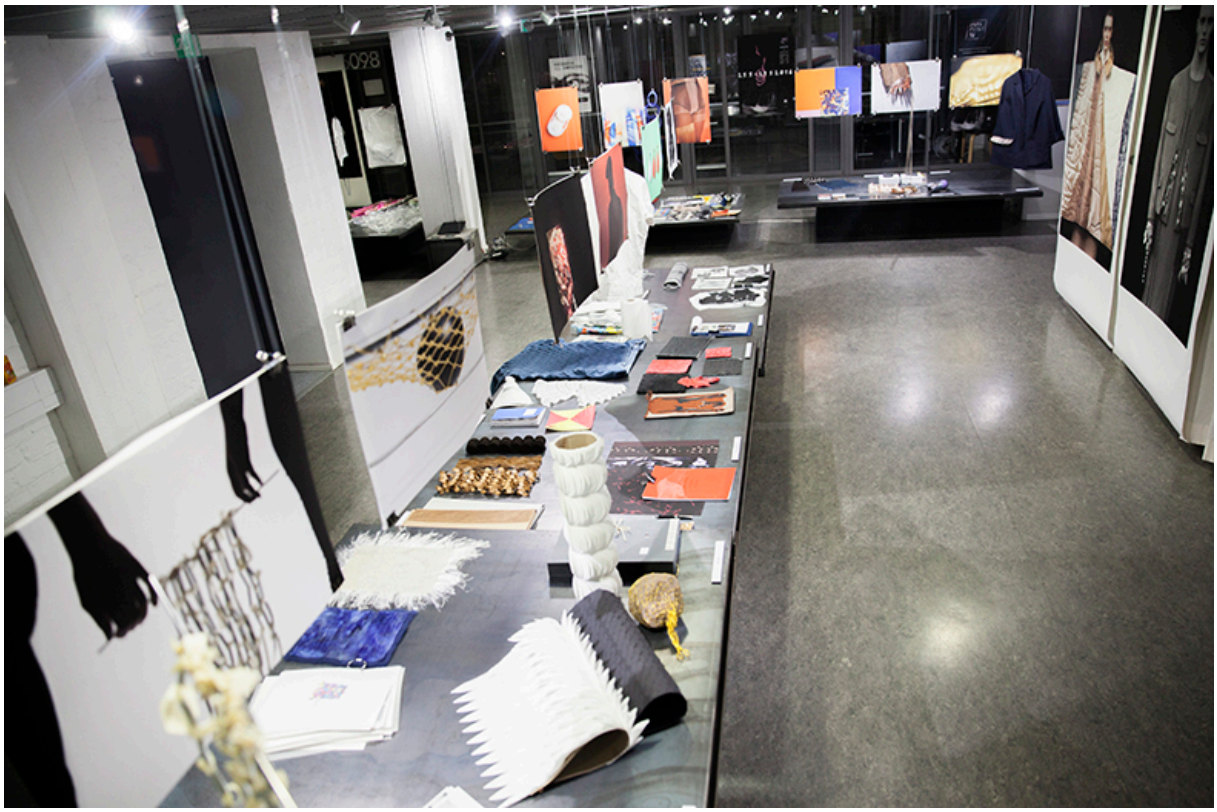
“Lucidum” is an e-textile project reflecting upon the ideas of lost and found. Design students Carolina Forss and Helmi Liikanen in collaboration with engineering student Teresia Borgman conducted this project through a more conventional and linear design approach. The goal was to propose a functional solution to the problem of finding items in deep and dark handbags and pockets. The project resulted in the design of a system of pocket that lights up when opened, using the pocket’s flap as the light switch. The technical challenges were addressed through experimenting with materials such as fibre optics and luminescent textile coatings, and embedding of electronic and conductive components. Collaboration of different disciplines can result in innovative yet realistic design solutions.

8. Conclusion

In the ETD module, students learn how to manage creative processes resulting in innovative products and combining textile techniques with skills from the fields of art, design, science and engineering. Design and engineering students learn to collaborate and conduct experimentations in multidisciplinary groups and to develop strong communication skills. The activity of designing and the designed object as the outcome is a valid source of data for reflection, analysis, and knowledge development (Pedgley, 2007; Bye, 2010).

The pedagogical purpose of the module is to cross the boundaries between disciplines. The aim and challenge of establishing fruitful collaboration is to overcome the conventional role distribution between engineers and designers based on their knowledge, background and skillsets. It is important to equally involve students throughout all phases of the course such as concept development, visual research, experimentations and technical research.

By disseminating knowledge, multidisciplinary platforms such as the ETD module build links between fields that will flourish within the academic system and provide future professionals with essential communication skills. Through redoing design pedagogy by opening the world of engineering to design students and especially by exposing design methodologies and the visual research processes to engineering students, we can help collaborative teams to redo the future.



ETD Exhibition, School of Arts, Design and Architecture, Aalto University – 2016 (photo credits: Eeva Suorlahti)

References

Bauersfeld H. (1995). "Language Games' in the Mathematics Classroom: Their Function and Their Effects", in P. Cobb & H. Bauersfeld (Eds.), *The emergence of mathematical meaning: Interaction in classroom cultures*, Hillsdale, US-NJ: Lawrence Erlbaum: 211-292.

Bye, E. (2010). *Clothing and Textiles Research Journal*, 28: 205, originally published online 21 June 2010, Retrieved Dec 28, 2016, from http://ctr.sagepub.com/content/28/3/205

Grzega, J., and Schöner, M. (2008). The didactic model LdL (Lernen durch Lehren) as a way of preparing students for communication in a knowledge society. *Journal of Education for Teaching: International research and pedagogy, 34*(3), 167-175. Retrieved from http:// dx.doi.org/10.1080/02607470802212157

Johnson, M. (2007). 'The stone that was cast out shall become the cornerstone:' The bodily aesthetics of human meaning. *Journal of Visual Art Practice, 6,* 89-103.

Koskinen, I., Zimmerman, J., Binder, T., Redström, J., and Wensveen, S. (2011). *Design Research through Practice: From the Lab, Field, and Showroom,* Morgan Kaufmann: USA: Elsevier

Pedgley, O. (2007). Capturing and analyzing won design activity. Design Studies, 28, 463-483.

Piaget, Jean (1976). *To understand is to invent: The future of the education.* New York : Penguin Books

Rhodes, L.K. and Bellamy, G.T. (1999). Choices and Consequences in the Renewal of Teacher Education. *Journal of Teacher Education, 50* (1) 17-25.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action.* New York, NY: Basic Books

Ulrich, K. T., and Eppinger, S. D. (1995). *Product Design and Development* (5th ed.) New Yor: MacGraw-Hill

Maarit Salolainen, Adjunct Professor for 3D Surface Design and especially textile materials, is an experienced international textile design professional with passion for bringing textile knowledge to multidisciplinary platforms. In addition to her academic work, she works as a creative director consulting in European and Indian textile manufacturers.

Jouni Partanen, Professor and head of Mechanical Engineering department, teaches and conducts research in advanced production technologies, such as Additive Manufacturing, modern laser processing, and micromachining. He is an experienced high technology industry leader (15 years) in product development, advanced research, production and product management.

Oldouz Moslemian, doctoral candidate at Aalto University within the Fashion/Textile Futures research group, is a teacher in Experimental textile Design course. Her research focuses on integrating digital fabrication processes and computational methods within the realm of textiles through multidisciplinary collaborations.

Eeva Suorlahti works as a teacher in Experimental Textile Design course. Her main area of interests is in visual research and communication through materials and techniques. Suorlahti has graduated from Central Saint Martins MA Fashion program focusing on mixed media textiles.

Panu Kiviluoma is a Senior University Lecturer at Aalto University Department of Mechanical Engineering. He has been instructing mechatronics and other interdisciplinary project courses since the 90's. He was granted *The Award for Achievements in Teaching 2012* by the School of Engineering.

Kirsi Niinimäki is an Associate Professor in Design, especially Fashion research. Her research focuses on holistic understanding of sustainable fashion and textile fields and connections between design, manufacturing, business models and consumption. She also runs the Fashion/Textile Futures research group http://ftfutures.aalto.fi.

Acknowledgements: We want to thank the engineering and design students of Experimental Textile Design course 2016 for inspiration and open-minded attitude and great work.