form ACADEMIC AKADEMISK
FORSKNINGSTIDSSKRIFT FOR DESIGN OG DESIGNDIDAKTIKK

ISSN 1890-9515 Vol 18, No 1 (2025), Art 7, 1–31 https://doi.org/10.7577/formakademisk.5726

Peer reviewed article

Learning challenge accepted – or not?

Designing T-shirts or demanding personalized garments

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Keywords
Clothing design, design constraints, design education, circumstance-based design

Abstract

This research studies garment design and production as an integrated learning assignment. In this type of setting, students face – often implicit – design constraints arising from the production phase: time, cost and material resources, but also students' knowledge and skills related to processes, tools, technical structures and technologies. The qualitative data analysis revealed that skill level did not dictate the level of learning challenge undertaken, and that not all novices' work remained limited to simple designs and structures. We discuss tailoring pedagogical practices according to students' needs by balancing familiarity with the challenge and the possibilities of circumstance-based design. We also suggest that, together with students' beliefs about the learnability of design creativity, all constraints should be openly discussed.

Introduction

Design ideation and processes have been the subject of intense research for more than 40 years (Cross, 2004). However, empirical research on the higher education design pedagogy in general is scarce (Sawyer, 2017), and apparently, this situation is much the same for garment design education. Considering that, for instance, fashion design education is a continuously expanding global market that accounts for approximately EUR 760 million per annum (Lin, 2023), a significant potential for pedagogically oriented research exists; especially because the related pedagogical practices vary between different countries significantly (Lin, 2023).

One of these scarce studies on design pedagogy was conducted by Sawyer. His ethnographic study (Sawyer, 2017) on higher education design pedagogy included 15 design disciplines, 38 instructor interviews, and the observation of 15 studio classes, with the findings being validated by 22 professors. Sawyer's (2017) findings include the centrality of reflection and design constraints – that is, practices that scaffold students through the creative design process. In general, a constraint refers to a restriction with which the solution must comply (Eckert & Stacey, 2014). For Sawyer (2017), constraints also include the processes that students must follow. Sawyer provides process examples, such as the following: 'Create 20–30 small thumbnail sketched ideas. Prepare three larger, more refined page layouts, with as much range and variety as possible.' (Sawyer, 2017, p. 145). In other words, the tasks defined in the design brief – the design practices that produce the creative outcome – represent both scaffolds for and limitations relating to the creative process.

Sawyer is not the only one to discuss design constraints (see, e.g., Herrmann et al., 2018; Lawson, 2006). Eckert and Stacey (2014) recognised three sources of constraints: the

problem to be solved, the (design and production) process through which the problem is solved and the emerging product (i.e., each decision constrains further development of the solution). They note that not all constraints are explicitly stated, but remain implicit. Moreover, these implicit constraints can unfold as the process proceeds. For the purposes of this study, the most interesting source of constraints mentioned by Eckert and Stacey (2014) was the process. They shortlisted these constraints as time, cost and resources. On a more detailed level, their list includes (amongst other things) skills, experience, production technology, materials and other resources required for production and the amount of effort that can be invested (Eckert & Stacey, 2014). This long list suggests that when a closer look is taken at each of the tasks included in a design brief, a whole set of constraints needs to be considered. Of these constraints, many are related to student motivation and the capacity to learn new and enhance existing skills. Moreover, these constraints have the potential to meaningfully limit ambition and innovation.

However, the process-related constraints listed above are not always accounted for when students' design processes and learning are studied. Many of these constraints are determined by the pedagogical design – by the teacher. Teachers need to consider balancing the course schedule, the required student effort and other demands with students' knowledge, skills, ambitions and other student resources. When students face a learning assignment that involves both artefact design and production, the character of the design challenge changes. Instead of facing a 'pure' design task with leeway for ambitious outcomes and innovative ideas, students encounter a task that requires balancing their design ideas and ambitions with their existing and aspirational production skills and other available resources. Therefore, in the educational contexts involving design that involves the production of finalised artifacts that will be assessed, it is likely that the design challenge will be transformed into a challenge to learn new production skills. To be motivating, this challenge should remain at a suitably reasonable level: ambitious and encouraging, but reachable.

While students' knowledge and skills of the production process might not be considered significant in all contexts of design education programmes and design learning tasks, this constraint is noteworthy, for instance, in Finnish craft education. Since 1994, Finnish national core curricula for basic education have promoted holistic craft process – that is, a process that involves both the design and construction of craft artefacts (Pöllänen, 2020). Therefore, university-level craft teacher education acquaints students with the holistic craft process and related pedagogical practices. This is also the wider context of this study: Finnish craft teacher education.

This study belongs to an educational design research project that, along with the general principles of educational design research, has two-fold objectives: to develop pedagogical practices and to further related theory (McKenney & Reeves, 2013). Therefore, this study aims to identify the pedagogical framings and practices of garment design and production for higher education that are suitable for students who are not only learning to design and make personalised garments, but also, in the long run, to teach those skills. This creates a double pedagogical challenge: while applying pedagogical practices suitable for these students, teachers should also provide pedagogical models that the students can later apply in their own classrooms. In addition, this study aims to further theory-building related to garment design education. Central to this theory-building is the acknowledgement that assignments involving the design and production phases are loaded with constraints that are not often accounted for in research.

To provide the background for our research on the pedagogical framings of garment design in higher education and, in particular, as part of the Finnish educational system, we first review the pedagogical research on garment design in higher education and then complement that by describing the various instances in which garment design appears across the Finnish education system and the related research.

Pedagogy for garment design in higher education

In this study, we have chosen to use the terms garment and garment design to differentiate from industrial processes, which utilise terms such as apparel, clothing and fashion design. Some of the related terminology (apparel, clothing, dress and fashion) have been defined by Kaiser (1998) (Table 1). Notably, Kaiser (1998) does not define 'garment'. According to the Cambridge Dictionary, a garment (“garment”, n.d) refers to 'a piece of clothing'. In this study, a garment refers to a piece of clothing constructed from fabric. Accordingly, we use garment making to refer to the process of pattern drafting/selection, cutting fabric, sewing a prototype garment for fitting purposes, making the required alterations and finally, sewing the final garment.

To verify Sawyer's (2017) claim about the paucity of pedagogical research and to understand the current status of higher education research on garment design pedagogy, student achievement, grading and student motivation, we conducted a literature review. Scopus and Design and Applied Arts Index (DAAI) were searched for peer-reviewed research that included the words 'apparel design education', 'fashion design education', 'garment design education' or 'clothing design education' in the title, abstract or keywords. The search produced a list of 67 items, including journal articles (44), book chapters (8) and conference

proceedings (15), of which three major themes arose: Education, Fashion as a phenomenon and the Industry's view on design.

Table 1

Basic terminology, according to Kaiser (1998).

Term	**Kaiser's definition** (Italics and notes in parentheses in original)	**References**
Apparel	A body covering, specifically referring to actual garment constructed from fabric (Sproles, 1979). (This is a term often used by industry.)	Sproles, G. B. (1979). Fashion: Consumer Behavior Toward Dress. Burgess.
Clothing	Any tangible or material object connected to the human body.	
Dress	(Noun) The total arrangement of all outwardly detectible modifications of the body itself and all material objects added to it (Roach and Musa, 1980).	Roach, M. E., & Musa, K. E. (1980). New Perspectives on the History of Western Dress. Nutriguides.
Fashion	A dynamic social *process* by which new styles are created, introduced to a consuming public, and popularly accepted by that public (Sproles, 1979, p.5); as *object*: a style accepted by a large group of people at a particular time (Kefgen & Touchie-Specht, 1986).	Sproles, G. B. (1979). Fashion: Consumer Behavior Toward Dress. Burgess. Kefgen, M., & Touchie-Specht, P. (1986). Individuality in Clothing Selection and Personal Appearance. Macmillan.

Upon closer examination, the theme Education (n = 46) focused on immersive and engaging technologies, such as virtual reality, e-textiles and online tools. The theme Fashion as a phenomenon (n = 12) focused on industry challenges, forces shaping the phenomenon of fashion and pathways for the future. The third theme, Industry's view on design (n = 9),

focused on environmental sustainability and social responsibility. Across these themes, multiple sustainability-related aspects and potential developments were actively discussed.

To conclude, the identified literature took the view of the design tools and industry challenges (i.e., the content to be taught) rather than describing and evaluating the implemented pedagogical solutions (i.e., how to organise teaching or learning within a certain learning environment), related grading practices or student experience (e.g., learning and motivation). In the light of this literature review, Sawyer's (2017) claim also appears valid for garment design education. Next, we turn to Finnish garment design education to further describe the wider context of this study and to identify any potentially relevant pedagogical research.

Garment design in the Finnish education system

Garment design appears in several forms and at several levels of the Finnish education system, from basic education to higher education. Design, technology and crafts (in one form or another) have been a compulsory part of general education since the very beginning of the public school system in the 1860s (Härkki et al., 2023; Marjanen & Metsärinne, 2019). The school subject is called crafts. For some time now, craft education has aimed at mirroring expert practices and cultivating designerly ways of thinking and practicing (Pöllänen, 2009; Seitamaa-Hakkarainen & Kangas, 2013). Central to craft education is the so-called holistic craft process. This notion emphasises how pupils are engaged in a creative craft process that generally involves four phases: ideation, design, making and the reflective evaluation of the output and the process (Pöllänen, 2009). While clothing has always been part of the craft subject, the space given to it in the curriculum has varied from decade to decade (Härkki et al., 2023). At this level, garment design is combined with garment making and the teaching of sewing technology. As a result, many pupils have some experience of designing and sewing a simple personalised garment, such as a T-shirt, shorts or a hoodie. By personalised, we refer to garments that one designs either for oneself or for a known person and which can be based on detailed knowledge of the user's preferences, needs and usage circumstances.

The upper-secondary level has two parallel sectors: general and vocational. Some general upper-secondary schools offer elective craft diploma courses. The objective of the craft diploma is to facilitate students to advance their skills in designing and making high-quality craft products – such as garments – as well as in assessing their own expertise (Finnish National Board of Education [FNBoE], 2020). Vocational education schools offer various degree programmes focused on fashion, apparel sewing and interior design for dressmakers and tailors.

Higher education has two sectors: universities and universities of applied science. Fourteen universities focus on scientific research and offer education based on it, and 24 universities of applied sciences offer pragmatic education according to the needs of working life. Two universities offer fashion design programmes (Aalto University, University of Lapland), while one university of applied science (South-Eastern Finland University of Applied Science Xamk) has a design programme specifically focusing on clothing. However, four other universities (the Universities of Helsinki, Turku, Eastern Finland and Åbo Akademi) provide teaching in clothing, garment design and making to cover the national need for craft subject teachers. This craft teacher education follows the Finnish National Core Curriculum for Basic Education (FNBoE, 2014). To qualify as a teacher of a craft subject at the basic education and upper-secondary levels, students have to complete a 5-year academic programme that includes obtaining a Bachelor of Arts (in Education) degree (180 ECTS) and a Master of Arts (in Education) degree (120 ECTS).

In general, design programmes are known for their high degree of personal creative input, whereas design education offered through craft teacher training programmes focuses on versatilely utilising various material technologies during a holistic craft process and on the teaching of crafts (i.e., craft pedagogy). Despite this difference, there are similarities between design education and craft teacher education programmes. Neither of them is traditionally academic; thus, they do not centre on essays and examinations, but rather on practical and studio work (e.g., Austerlitz & James, 2008; Lahti et al., 2022). Various skills are required to study successfully when taking these courses, yet educational institutions at the lower levels do not provide an equivalent background for all students. Students' uneven skill levels challenge many practical courses, which, in turn, could create a motivational challenge for both over- and underperforming students. This is one of the key starting points for our long term research agenda: how to inspire all students (regardless of their gender, clothing habits, garment design or sewing skills) to design demanding personalised garments, especially when the learning assignment involves both the design and production phases.

As Finnish national core curricula have promoted holistic craft process – and design – since 1994 (Pöllänen, 2020), teacher educators have invested in design-related research (e.g., Nuutinen et al., 2014; Kangas, 2014; Viilo, 2020). Pedagogical approaches, such as learning by collaborative design (Seitamaa-Hakkarainen, et al., 2010), non-linear pedagogy (Härkki et al., 2023; Hakkarainen & Seitamaa-Hakkarainen, 2023) and invention pedagogy (Korhonen et al., 2023), have predominantly been developed, to support teachers in basic education to teach designerly thinking and practices. However, research on garment design has remained limited. Exceptions include Lahti and Nuutinen (2014), Seitamaa-Hakkarainen et al. (2005), and Omwami's (2024) dissertation, all of which explore the possibilities of concept design

and peer collaboration in the contexts of textile and garment design education. Furthermore, Oksanen-Lyytikäinen's (2015) dissertation studied the meanings of costume and costume design in the context of opera production. However, production as a design constraint is not addressed.

Our research aims most closely align with Laamanen's (2012) study on student craft teachers' challenges in the design idea generation phase. She noted that students were not familiar with ideation methods (such as sketching, fabric collage and material experiments). These unfamiliar learning tasks aroused insecurity, self-criticism, disorientation and lack of motivation. Students questioned whether designing could be learned. Laamanen (2012) suggested taking these beliefs seriously, providing opportunities to discuss and reflect, and ensuring that taught practices support students' self-efficacy and self-generated learning. For instance, she suggested material and verbal methods (rather than sketching, which student craft teachers could find challenging). In other words, students' beliefs need to be challenged by scaffolding students throughout the design process by tasking them to use designerly practices that are not too unfamiliar for them. Furthermore, Laamanen (2014) discussed the importance of student motivation, which could be endangered by constrained design skills. She suggested carefully considered and appropriately scaffolded pedagogical designs. Furthermore, the designs should drive students to make personally meaningful decisions, without which design learning might not occur (Laamanen, 2014).

Research questions

This study has two-fold aims. Firstly, to identify the pedagogical framings and practices of garment design and production for higher education that are suitable and motivating for students who are not only learning to design and make personalised garments, but also, in the long run, to teach those skills. Secondly, to further theory building related to garment design education. Towards these aims, we examine an approach to organizing a master's-level clothing course that tasked student craft teachers with designing and making a challenging upper-body garment. We set three research questions. First, to understand how the pedagogical design succeeded in scaffolding student work and motivation, we asked:

RQ1: What kinds of garments did the students design?

RQ2: Did the students consider the garment design tasks motivating?

Then, to enhance our understanding of student motivation and learning aspirations, we asked:

RQ3: When asked to choose, what kind of course plan did the students see as most suitable for future course implementation?

The following introduces the details of the course in question and the study participants. Then, we present the analysis method and the results that illustrate the variety of garments produced by the students, students' preferences in regard to the course learning tasks and the future course implementation plans. We conclude by discussing future directions and a circumstance-based design approach, that could provide the needed balance between student motivation, and creative and technical challenges, and a more motivating grading of student work.

Methodology

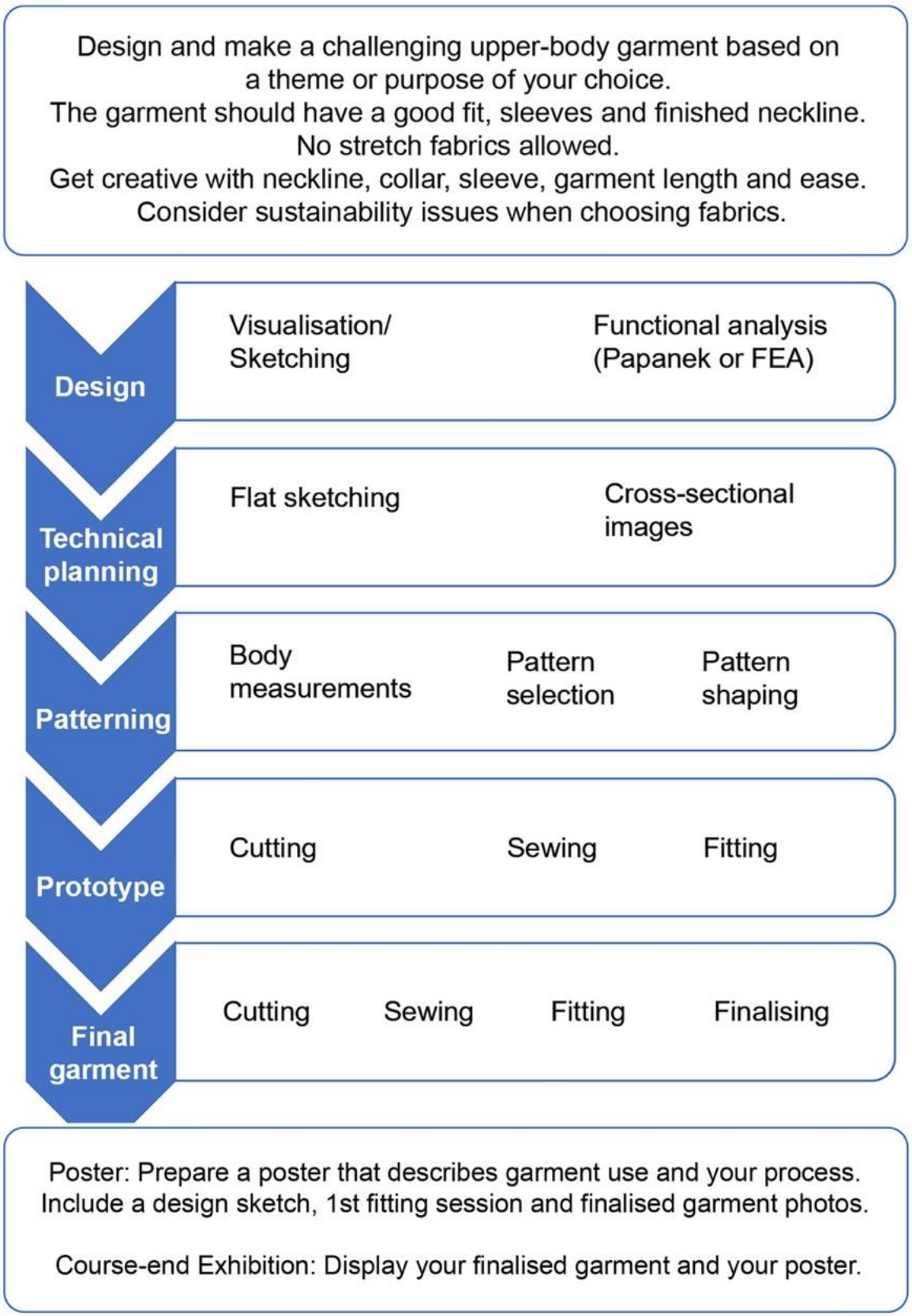
A master's-level clothing course

Our ongoing research project focuses on a compulsory master's-level course 'Clothing and Consumer Behaviour' (5 ECTS). Two of the authors had teacher–researcher roles in this course. The course objectives entail not only learning to design and make demanding garments, but also learning to teach garment design and making to pupils at the primary and secondary levels. Prior to this course, students take three related bachelor's-level courses: Product Design in the Teaching of Crafts (6 ECTS), Sewing Technology and Circular Economy (3 ECTS) and Clothing Technology (3 ETCS).

At the beginning of the course, students completed a pre-questionnaire on their capabilities in garment designing and making and, at the end, a post-questionnaire to evaluate their learning. Course lectures introduced the central concepts of clothing and clothing physiology (such as fit and ease, thermal and mechanical comfort), clothing design and its visualisation, analysis frameworks for garment design (such as Papanek's Function Complex [1995] and Lamb and Kallal's FEA Model [1992]), patternmaking and fitting, as well as the circular economy and consumer literacy from the clothing perspective. During the lectures, a range of images depicting upper-body garments for men and women were examined to understand degrees of fit and ease, and how various factors such as materials, techniques and patterns could elicit a range of associations.

Figure 1

Course project stages and tasks.



The course tasked students with designing and making a challenging, personalised garment based on a freely chosen theme or purpose. The set design constraints for the project included a well-fitting upper-body garment designed for oneself, with sleeves and a finished neckline. Additionally, students were encouraged to be creative with the neckline, collar, sleeve, garment length and ease, and while considering sustainability issues, they were given the freedom to use materials of their choice. However, one constraint regarding materials was set: The use of stretch fabrics (e.g., containing elastane) was forbidden. This constraint was met with significant resistance, especially by many male students. Furthermore, students were required to make a well-fitting prototype before finalizing their project. Together with the finalized garments, the students were to deliver a poster of their process and an analysis of their intended usage (Papanek or FEA). All student-produced course materials (e.g., sketches, technical drawings, posters, videos) were collected as research data. All the course tasks and related materials are specified in Figure 1.

Functional analysis with FEA or Papanek was intended to play a significant role in the designing. Therefore, we analysed students' utilisation of these analysis models in another study (Rönkkö & Härkki, 2024). Students were free to choose between the two models. According to these findings, most of the students chose Papanek. However, the students tended to overlook several dimensions and criteria of the models in their functional analyses. Listing the same – or very similar – issues underneath several dimensions suggests that the models did not provide the intended scaffolding for finetuned analysis, and that some of the wording in the models was more alienating than inspiring.

Research data

The primary data for this study comprised of students' answers to the pre-questionnaire, students' posters and their post-course interviews. Of the 35 student craft teachers (22 female, 13 male) on the course, 23 (15 female, 8 male) gave their informed consent to utilise their course materials as research data. According to the pre-questionnaire, none of the 23 study participants had prior training in dressmaking. When asked to rate their skills in pattern making, fitting and sewing using a school-grade scale (4–10, also used in Finnish basic education), 6 students considered their skills to be better than grade 8 (advanced level) and 17 considered their skills at grade 8 or less (novices). Almost all male students (seven out of eight) were novices, according to this measure. No questions specifically targeted students' experience in garment design, as in levels below higher education, garment design and making are typically interconnected (as a so-called holistic craft process).

To gain a deeper understanding of the students' priorities, their learning and the meaning of clothing, and to calibrate our views on how to revise the course, we interviewed 12 students

(8 male and 4 female; 3 advanced and 9 novices). When selecting the interviewees, we aimed at capturing a diverse range of perspectives, taking into account factors such as age, gender, previous experience with dressmaking and clothing and, last but not least, interest in garment design and making shown during the course. Three of the interviewed students had not given their informed consent to use their coursework, but they were willing to consent to the final interview. Two of these students were male novices whose coursework was structurally basic but represented a medium-level learning challenge for them, a student group that is specifically challenging from a teacher's viewpoint.

These in-depth interviews were conducted remotely by one of the teachers, an experienced interviewer. She used a semi-structured interview guide to ensure that all participants were asked similar questions, while also allowing for spontaneous follow-up questions as needed (Kallio et al., 2016). The interview topics consisted of exploring the importance of clothing both in general and as a component of their master's studies, categorising course assignments into those that were more or less motivating, assessing students' prior experience in dressmaking and evaluating their satisfaction with their learning and coursework. Additionally, four alternative course plans were presented to the students individually, followed by a question asking which alternative course plan they preferred in comparison to the one that they had already completed. The interviews were audio-recorded via Zoom, transcribed verbatim and analysed with thematic analysis (Braun & Clarke, 2006).

Findings

Did students design demanding and challenging garments – or not?

The coursework's objective was to design and develop a demanding, personalised upper-body garment. Considering technical garment structures in this course context, 'demanding' translates into a jacket, a coat or a dress with a good fit, 'medium' involves structural details (such as collars, cuffs and pockets) and some level of fit, while 'basic' involves a relaxed fit (e.g., no darts) and very few structural details. Table 2 summarises the garments designed by advanced and novice students according to their level of structural difficulty, and Figures 2–4 exemplify demanding-, medium- and basic-level structures designed by the students.

Table 2

Level of structural difficulty of the student-designed garments.

	NOVICES		ADVANCED	
	FEMALE	MALE	FEMALE	MALE
BASIC	3	2	3	1
MEDIUM	3	5	1	0
DEMANDING	4	0	1	0

Figure 2

An example of a basic-level garment: a short-sleeved shirt, described by the creator as a 'relaxed, loose-fitting and cool shirt for parties, the beach and free time'. Photo source and courtesy: Student N3.

Figure 3

An example of a medium-level garment structure: a collared long-sleeved shirt, described by the creator as 'a shirt for significant events, such as my graduation party, with details including wooden buttons with my name inscribed'. Photo source and courtesy: Student N4.

Figure 4

An example of a demanding garment structure: denim jacket with several details, described by the creator as a 'fancier jacket for many purposes, with pockets roomy enough for my mobile phone'. Photo source and courtesy: Student N5.

Many novices' designs were structurally more demanding than the advanced-level students' designs, especially in the case of female novices. Overall, the level of structural difficulty remained lower than that aimed for by the teachers. When considering students' designs in relation to their individual skills, it appeared that male students took on greater challenges. In addition to structural difficulty, the level of learning challenge taken on by the students (Table 3) involved choices of fabric and, in some cases, personalised details, such as complex vinyl-cut decorations (Figure 5). Overall, the suggestion to get creative with details, such as collars or pockets, was not widely adopted, even though these details can be produced in various ways that are structurally not particularly demanding yet could add more personality to the garment. Nevertheless, as Table 3 suggests, female students appeared to take on smaller challenges.

Table 3

Level of the individual learning challenge taken on by the students.

	NOVICES		ADVANCED	
	FEMALE	MALE	FEMALE	MALE
SMALL	4	0	3	0
INTERMADIATE	2	5	0	1
LARGE	4	2	2	0

Figure 5

A vinyl-cut decoration on the back of a bomber jacket. Photo source and courtesy: Student N6.

These results beg the question as to why so many of the designs remained at a basic or medium level and why the learning challenges that were taken on were often small. The most significant underlying reason that was recognised from the many discussions between the course teachers and students was linked to the students' motivation to make something that they needed and that was doable using their current skills. The course starting point was a freely chosen theme or purpose, and in the interviews, this was stated as a major motivational factor. Here, as MbK phrased it, 'Maybe the most inspiring thing was the chance to make a garment for myself and something that I'd wear in the future' (MbK, novice, male).

For many students, the purpose was their graduation party. For females, this translated into a dress, and quite often into a dress that they had seen in some pattern book or shop window. For males, the graduation party meant there was a need for a collared, long-sleeved shirt. Additionally, several male students struggled with the idea that stretch fabrics were forbidden (due to the learning objective of creating a well-fitting garment). They claimed to have only stretchy upper-body garments in their current wardrobes, questioned the need for any other type and claimed that the only alternative to a T-shirt or a hoodie was a 'standard' collared shirt, for which they saw no need. As TU noted in the interview, 'In a way, it was rather restricted regarding what garment it could be for males, as no stretchy fabrics were allowed, an upper-body garment and some type of finished neckline were required, and it really was restrictive so that no real alternatives truly existed' (TU, male, advanced).

A fixation on these pre-existing ideas reduced motivation for – and, therefore, the significance of – functional analysis and structural designing. The designing aspect appeared to proceed effortlessly, as students had already decided what to make. Simultaneously, it was difficult for teachers to motivate students to learn more demanding structures. The following interview comment by JM reflects the typical attitude towards designing: 'Well, for visual planning, we're asked to make several sketches and so, even if there was already, from the start, a certain idea in my mind, I still needed to sketch more than one' (JM, novice, male).

To summarise, personalisation was an important motivating factor for the coursework. Yet, in general, the dressing needs that the students chose did not support taking on large challenges. We can only speculate regarding whether the larger challenges taken on by the males could signal a more optimistic view of their resources (existing skills as well as the time and effort required in order to learn), or whether they were more motivated to excel and learn. In general, the challenges that were undertaken were fewer than expected. Advanced skills did not guarantee expected performance. However, being a novice was not

an obstacle to designing a demanding garment and accepting the learning challenge. This is pedagogically promising and likely the most important finding.

Students' views on motivating garment design tasks

In addition to having already decided on their coursework prior to the course, several students said that they favoured garment sewing over designing. As BB put it, 'It's the sewing which is the coolest and most exciting thing' (BB, novice, female). In the interviews, students rated the garment design tasks (Table 4).

Table 4

Garment design tasks rated by the interviewed students (N = 12).

	INTERESTING		NEUTRAL		NOT INTERESTING	
TASK	NOV/ADV	FEMALE/MALE	NOV/ADV	FEMALE/MALE	NOV/ADV	FEMALE/MALE
GARMENT SKETCHING	6/0	1/5	2/3	3/2	1/0	0/1
FUNCTIONAL ANALYSIS	1/0	0/1	2/2	1/3	6/1	3/4
FLAT SKETCHING	0/0	0/0	5/1	2/4	4/2	2/4
CROSS-SECTIONAL IMAGES	0/0	0/0	5/1	2/4	4/2	2/4

Out of all the design-related tasks, sketching received the most favourable rating from the students, but tasks such as functional analysis (Papanek or FEA), flat sketching and drawing cross-sectional images were not met with enthusiasm either. Again, BB summarised the feelings of her many of her peers: 'Functional analysis was kind of challenging to grasp. I wondered why we were doing this and how these topics [Papanek/FEA dimensions] were related to my planned garment. It was, it was challenging to think about that' (BB, novice, female). One advanced student found it difficult to start designing, or as she put it, 'I did not have any clear vision', yet after functional analysis, when she found a fabric she liked, and suddenly she knew what she wanted to do: 'It all became clear when I got a clear visual

image in my head' (IT, advanced, female). For her, materials were a central source of inspiration, and paper-based ideation felt strange to her.

Considering that these students should soon be able to teach basic education pupils at the level to ideate and design, their explicated thoughts about designing were troubling. The students' design behaviour did not follow the guidance that was given – guidance for this course but also for many previous courses, as, according to the notion of 'holistic craft process', design is a topic that permeates their study programme. The students did not experience the tasks aimed at facilitating and enriching their creative processes as inspiring, motivating or supportive.

Students' course plan preferences

Clearly, the course needed revisions. We drafted three possible course plans and asked each student individually whether they would prefer the course that they had just completed or alternative A, B or C. For alternative A, the starting point would be functionality: situational needs and circumstances rather than visual impressions and sketching. Alternative B would first discuss the circular economy sustainability issues, the garment's lifecycle and issues related to recyclability and consumerism, while alternative C would emphasise ecological aspects related to fibres, fabric qualities and garment structures to maximise ease of care and adaptability throughout the garment's lifecycle.

When asked to choose, one (male novice) student preferred the existing course over all suggested alternatives, and two students (one male novice and one female advanced student) thought that all the alternatives (A–C) sounded more motivating than the existing course. Altogether, alternative A was rated as a clear winner: 10 out of 12 students voted for it.

This result was in stark contrast to the interview answers given by the students only a few minutes earlier when they had rated the tasks in the existing course. When reflecting on the ways in which to explain the alternatives, two likely explanations arose for students' preferring practically everything else over the existing course, which started with sketching and functional analysis via Papanek or FEA. First, even though sketching is a valuable thinking tool for designers (e.g., Purcell & Gero, 1995; van der Lugt, 2005), previous research has shown that student craft teachers are not accustomed to thinking through sketching (Härkki et al., 2018; Laamanen, 2012). This could also be the case here. Rather than starting with sketching, it may sound more appealing to start by verbalizing garment use and circumstances for functional analysis. Second, it could be that the models utilised for functional analysis in the course – Papanek and FEA – were not familiar enough to the students, although this course was not the first point of contact between the models and

these students. The proposed, more general formulation, starting with the situation and circumstances, may have sounded more approachable.

A way forward: More structured designing with a circumstance-based approach

'Theoretically or empirically informed discussions on design pedagogy are uncommon' (Oh et al., 2013, p. 30; see also Lee, 2009). Sawyer (2017) noted a paucity of empirical research on higher education design pedagogy, which resonates with the results of our small-scale literature review of the research on garment design pedagogy in higher education. Contemporary garment design research treats the contemporary challenges of the industry – and rightly so. However, the educational aspiration related to Finnish craft education emphasises the holistic nature of the craft process (Pöllänen, 2009). Build-a-thing tasks and the step-by-step production of artefacts were once common in craft education (Pöllänen, 2009; Seitamaa-Hakkarainen & Kangas, 2013), but the current national core curriculum orients craft education towards enhancing inventive, creative and inquiry-based learning (FNBoE, 2014). Altogether, Finnish craft teachers need to be able to teach ideation and design at the primary and secondary levels. This means that they are not professional designers, but they need a clear understanding of the basics of design. A commendable volume of research on product design, primarily focused on facilitating basic education teachers, has been produced (e.g., Korhonen et al., 2023). However, there has been a long-existing tradition in the basic education of learning assignments involving both phases of designing and making personalised garments. This advocates a continuing need for student craft teachers to develop the skills and knowledge for garment design and making practices, as well as the skills and knowledge for teaching of these practices.

This educational design research aims to identify pedagogical framings and practices of garment design and production for higher education suitable for student craft teachers and to further theory building relating to garment design education. To advance a research-based pedagogical discussion, we utilise the concept of constraints, as treated by Sawyer (2017) and Eckert and Stacey (2014). In particular, we highlight process-related constraints that can remain implicit yet powerful: students' overall resources that they are capable of investing in their learning assignments. When design is combined with production, students' production-related knowledge, skills and other resources have the potential to meaningfully restrain their creativity. If students' learning is heavily tilted towards learning production skills and undermining their design capabilities, the learning objectives of craft teacher education related to creative practices are not fulfilled.

Naturally, there are many possible explanations for student achievement. The learning assignment could be seen as involving three types of constraints: 1) the need for *demanding garments* (structures, fabrics, details), 2) the need for *personalized garments* (giving students the freedom to set constraints for themselves and strive to meet their ambitions, within the limits, such as, for instance, using only non-stretchy fabrics) and 3) the *capabilities and motivation to proceed with the learning tasks* (such as sketching, functional analysis via FEA or Papanek). Moving from T-shirts and hoodies towards a more sophisticated and versatile understanding of clothing was effortful for some students. A narrow variation in a student's own wardrobe does not support that student in noticing often subtle differences in shirt and jacket structures and details presented during the lectures. More focused examinations are needed to build an understanding of the variations and the technical sophistication of these variations. In these data, structurally, the garments were often closer to basic than to demanding. For many, the main motivation was the possibility of creating something personalised for themselves – yet they had already chosen the designs before the beginning of the course. These students aimed to produce purposeful designs that they needed in the foreseeable future. This could reflect their understanding of sustainable design. Yet, that was not a fertile starting point for ideating and designing and, in some cases, for taking the opportunity to learn and challenge oneself.

Clearly, not all learning opportunities were fully embraced and capitalised on. In general, however, the students were content with the course. In the interviews, only one advanced and two novice students claimed that they were not fully content with their learning, and one novice was not fully content with his coursework. This could suggest that they had adapted their efforts to align with the course's 'official' constraints and to the implicit, process-related constraints, such as time, cost and resources. However, a pedagogically important finding was that demanding garments were designed and made by both, advanced and novice students. Prior skills were not the only factor involved in students accepting the learning challenge.

Design has been identified as an iterative process of exploration, ideation, finding and describing a problem (Cross, 2011). This process is facilitated by the creation of and reflection on drafts, sketches and prototypes (Halverson & Sheridan, 2014). The learning assignment included the production of several design representations, prototypes that were fitted, and the production of the final garment. These tasks were rated by the students in the interviews. The interviews conducted by the teacher–researcher provide research data and feedback for the teacher, but they also provide an opportunity for the teacher to facilitate students' self-reflection, a learning opportunity for both the teacher and the student. Even if belatedly, the interviews also provided a way to openly discuss about

students' preferences, prior experiences and beliefs related to these learning tasks, as suggested by Laamanen (2012). It could be argued that students' answers would have been different if an outsider had conducted the interviews. However, the students appeared to be relaxed, outspoken and eager to give constructive feedback. Moreover, their responses largely corroborated earlier findings by Laamanen (2012, 2014). Practices that were unfamiliar or too abstract were not experienced as supportive, and were at least partially rejected by many. Laamanen (2012) suggests utilising open discussions on students' prior experience and beliefs alongside prioritising material and verbal ideation methods over sketching. She discussed also student motivation in relation to tasks experienced as too difficult (Laamanen, 2014). As students enter craft teacher education with differing craft and design skills and learning aspirations, the key pedagogical question is how to inspire these students, regardless of their gender, habits or skills. To identify motivating types and levels of challenge, we suggest open discussions on process-related constraints and the implicit constraints visible to students, but not necessarily to teachers. The assignments need to be ambitious and encouraging, yet reachable.

For this course, we identified several potential changes. Rather than visuals and sketching, designing could start with situational needs and circumstances, as planned in alternative A, which the interviewed students preferred. As a starting point for developing the next course iteration, we chose a circumstance-based design approach that understands clothing needs and habits as situational and recognises users as part of the natural and built environments (Laxström et al., 2021). This approach is based on the systematic analysis of fluctuating, changing and unpredictable circumstances. All kinds of physical, psychological, social, cultural, political and virtual environments are considered. Physical conditions are viewed as living or operating circumstances formed by nature and the man-made environment. Physical circumstances can be divided into elements of the environment that can be experienced and perceived with different senses. Regarding psychological circumstances, the emphasis is on the human's inner world of experience. The emotions and sensations produced by the physical environment are also closely related. Social circumstances are created through interactions between people. Cultural circumstances are closely related to social circumstances, which include, for example, the attitudinal atmosphere shaped by traditions and values (Laxström et al., 2021). When compared with the (potentially too abstract) Papanek and FEA models, meanings and solutions related to different dimensions of circumstance-based design could be more intuitively available for students.

Furthermore, circumstance-based design emphasises two pedagogically important viewpoints. The first involves the importance of the overall process of designing, manufacturing and understanding the environmental impact of the garment. Ideally,

personalised garments are designed for product longevity and embody ideas resonating with emotionally durable design (Chapman, 2005) and psychologically durable design (Haug, 2019). Second, while the grading of students' coursework has traditionally occurred at the end of the process and has focused on the finished product, this approach emphasises a reflective, documented design process (Laxström et al., 2021). This emphasis on the whole – designing and making as a holistic craft process – could also motivate students who are not skilled in or predominantly motivated by the actual production of the garment. It also facilitates makes visible many implicit constraints – those that serve as important scaffolds for students' processes.

Completed with collaborative feedback on the identified circumstances and their mapping towards garment structures and features, circumstance-based design could enhance students' collective understanding of issues enriching and constraining the garment design process in general. This kind of understanding is valuable for future teachers. Furthermore, developing one's understanding of relevant circumstances through collaborative discussions could reduce fixations on pre-existing ideas and facilitate a move from T-shirts towards demanding personalised garments.

ACKNOWLEDGMENTS

We would like to warmly thank all the participating students for sharing their experiences and giving their permission to publish the photographs of their garments.

Reference

Austerlitz, N., & James, A. (2008). Reflections on emotional journeys: A new perspective for reading fashion students' PPD statements. *Art, Design & Communication in Higher Education, 6*(3), 209–19. https://doi.org/10.1386/adch.6.3.209_1

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Chapman, J. (2005). *Emotionally Durable Design: Objects, Experiences and Empathy*. Earthscan. https://doi.org/10.4324/9781315738802

Cross, N. (2004). Expertise in design: An overview. *Design Studies, 25*, 427–41. https://doi.org/10.1016/j.destud.2004.06.002

Cross, N. (2011). *Design Thinking: Understanding How Designers Think and Work*. Berg. https://doi.org/10.5040/9781350305090

Eckert, C.M., & Stacey, M.K. (2014). Constraints and conditions: drivers for design process. In A. Chakrabarti & L.T.M. Blessing (Eds.*), An Anthology of Theories and Models of Design* (pp. 395–415). Springer. https://doi.org/10.1007/978-1-4471-6338-1_19

Finnish National Board of Education (FNBoE). (2014). *Perusopetuksen opetussuunnitelman perusteet (National Core Curriculum for Basic Education 2014)*. FNBoE. https://www.oph.fi/fi/koulutus-ja-tutkinnot/perusopetuksen-opetussuunnitelman-perusteet. Accessed 1 April 2023.

Finnish National Board of Education (FNBoE). (2020). *Käsityön lukiodiplomi (Crafts diploma).* FNBoE. https://www.oph.fi/fi/koulutus-ja-tutkinnot/kasityon-lukiodiplomi. Accessed 1 April 2023.

Garment. (n.d.). *Cambridge Dictionary.* Cambridge University Press. Accessed 1 April 2023 from https://dictionary.cambridge.org/dictionary/english/garment

Halverson, E. R., & Sheridan, K. M. (2014). Arts education and the learning sciences, in R. K. Saywer (Ed.), *The Cambridge Handbook of the Learning Sciences* (pp. 626–646). Cambridge University Press. https://doi.org/10.1017/CBO9781139519526

Hakkarainen, K. & Seitamaa-Hakkarainen, P. (2023). Learning by Inventing: Theoretical Foundations, in T. Korhonen, K. Kangas, & L. Salo. (Eds.) *Invention pedagogy—The Finnish Approach to Maker Education* (pp.15–27). Routledge. https://doi.org/10.4324/9781003287360-3

Haug, A. (2019). Psychologically durable design: Definitions and approaches. *The Design Journal, 22*(2), 143–67. https://doi.org/10.1080/14606925.2019.1569316

Herrmann, M.E., Goldschmidt, G., & Miron-Spektor, E. (2018, January 31st - February 2nd). The ins and out of the constraint-creativity relationship. In E. Dekoninck, A. Wodehouse, C. Snider, G. Georgiev, & G. Cascini (Eds.) *DS89: Proceedings of The Fifth International Conference on Design Creativity (ICDC2018),* Bath, UK. https://www.designsociety.org/publication/40712/THE+INS+AND+OUTS+OF+THE+CONSTRAINT-+CREATIVITY+RELATIONSHIP

Härkki, T., Seitamaa-Hakkarainen, P., Vartiainen, H., Saarinen, A., & Hakkarainen, K. (2023). Non-linear maker pedagogy in Finnish craft education. *Techne serien - Forskning i slöjdpedagogik och slöjdvetenskap*, *30*(1), 1–17. https://doi.org/10.7577/TechneA.4998

Härkki, T., Seitamaa-Hakkarainen, P. & Hakkarainen, K. (2018). Line by line, part by part: Collaborative sketching for designing. *International Journal of Technology and Design Education, 28*(2), 471-494. https://doi.org/10.1007/s10798-016-9379-7

Kaiser, S. (1998). *The Social Psychology of Clothing: Symbolic Appearances in Context*. Fairchild.

Kallio, H., Pietilä, A.-M., Johson, M., & Kangasniemi, M. (2016). Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing, 72*(12), 2954–65. https://doi.org/10.1111/jan.13031

Kangas, K. (2014). *The Artifact Project. Promoting Design Learning in the Elementary Classroom*. Home Economics and Craft Studies Research Reports 35. PhD Dissertation. University of Helsinki. http://hdl.handle.net/10138/136526

Korhonen, T., Kangas, K., & Salo. L. (Eds.) (2023). *Invention pedagogy—The Finnish Approach to Maker Education.* Routledge. https://doi.org/10.4324/9781003287360

Laamanen, T.-K. (2012). Design learning in Textiles Teacher Education challenges. *Procedia - Social and Behavioral Sciences 45,* 257–267. https://doi.org/10.1016/j.sbspro.2012.06.562

Laamanen, T.-K., & Seitamaa-Hakkaranen, P. (2014). Constraing the open-ended design task by interpreting sources of inspiration. *Art, Design and Communication in Higher Education, 13*(2), 135–156. https://doi.org/10.1386/adch.13.2.135_1

Lahti, H., Kangas, K., Härkki, T., & Seitamaa-Hakkarainen, P. (2022). Challenging creativity constraints: Three design studios in craft teacher education. *Techne Series: Research in Sloyd Education and Craft Science A, 29*(1), 1-12. https://doi.org/10.7577/TechneA.4250

Lahti, H. & Nuutinen, A. (2014). Yhteisöllinen konseptisuunnittelu vaatetussuunnittelun lähtökohtana. [Collaborative concept design as a starting point for garment design]. In A. Nuutinen, P. Fernström, S. Kokko & H. Lahti (Eds.) *Suunnittelusta käsin. Käsityön tutkimuksen ja opetuksen vuoropuhelua*. Home Economics and Craft Studies Research Reports 36, (pp. 134–152. University of Helsinki. http://hdl.handle.net/10138/153027

Lamb, J. M., & Kallal, M. J. (1992). A conceptual framework for apparel design. *Clothing and Textiles Research Journal, 10*(2), 42–47. https://doi.org/10.1177/0887302X9201000207

Lawson, B. (2006). How Designers Think? The Design Process Demystified. 4th ed. Elsevier. https://doi.org/10.4324/9780080454979

Laxström, K., Kylmänen, A., Oksanen, J., & Nuutinen, A. (2021). Olosuhdeperustainen suunnittelu [Circumstance-based design]. In S. Heinonen & S. Toivonen (Eds.) *Futura, 40*(4), 16. Tulevaisuuden tutkimuksen seura [The Finnish Society for Future Studies].

Lee, N. (2009). Project methods as the vehicle for learning in undergraduate design education: A typology. *Design Studies, 30*, 541–60. https://doi.org/10.1016/j.destud.2009.03.002

Lin, X. (2023). Fashion design education: A study of fashion design educational systems of Italy and China. *The International Journal of Design Education, 17*(1), 199–212. https://doi.org/10.18848/2325-128X/CGP/v17i01/199-212

Marjanen, P., & Metsärinne, M. (2019). The development of craft education in Finnish schools. *Nordic Journal of Educational History, 6*(1), 49–70. https://doi.org/10.36368/njedh.v6i1.124

McKenney, S., & Reeves, T. C. (2013). *Conducting educational design research*. Routledge. https://doi.org/10.4324/9781315105642

Nuutinen, A., Fernström, P., Kokko, S., & Lahti, H. (Eds.) (2014). *Suunnittelusta käsin. Käsityön tutkimuksen ja opetuksen vuoropuhelua*. Home Economics and Craft Studies Research Reports 36. University of Helsinki. http://hdl.handle.net/10138/153027

Oh, Y., Ishikazi, S., Gross, M. D., & Do, Ellen Y.-L. (2013). A theoretical framework of design critiquing in architecture studios. *Design Studies, 34*, 302–25. https://doi.org/10.1016/j.destud.2012.08.004

Oksanen-Lyytikäinen, J. (2015). *Costume as Art and as a Tool*. PhD dissertation. Home Economics and Craft Studies Research Reports 37. University of Helsinki. http://hdl.handle.net/10138/153100

Omwami, A. (2024). *From Inspiration to Garment Ideas: Elucidating the Threads of Inspiration in Apparel Design Ideation*. PhD dissertation. Helsinki Studies in Education 194. University of Helsinki. http://hdl.handle.net/10138/587753

Papanek, V. (1995). *Design for the Real World: Human Ecology and Social Change*. Bantam Books. https://doi.org/10.7551/mitpress/9370.001.0001

Purcell, A. T., & Gero, J. S. (1995). Drawings and the design process. *Design Studies, 19*, 389–430. https://doi.org/10.1016/s0142-694x(98)00015-5

Pöllänen, S. (2009). Contextualising craft: Pedagogical models for craft education. *International Journal of Art and Design Education*, *28*(3), 249–60. https://doi.org/10.1111/j.1476-8070.2009.01619.x

Pöllänen, S. (2020). Perspectives on Multi-Material Craft in Basic Education. *International journal of Design and Art Education, 39*(1), 255–270. https://doi.org/10.1111/jade.12263

Rönkkö, M.-L. & Härkki, T. (2024). Student Craft Teachers' Choices During the Garment Design and Making Process: A Qualitative Analysis of Posters. *Techne serien - Forskning i slöjdpedagogik och slöjdvetenskap*, *31*(3), 1–15. https://doi.org/10.7577/TechneA.5922

Sawyer, R. K. (2017). Teaching and Learning How to Create in Schools of Art and Design. *Journal of the Learning Sciences*, *27*(1), 137–181. https://doi.org/10.1080/10508406.2017.1381963

Seitamaa-Hakkarainen, P., & Kangas, K. (2013). Craft education: Authentic design constraints, embodied thinking, and craft making, in J. B. Reitan, P. Lloyd, E. Bohemia, L. M. Nielsen, I. Digranes and E. Lutnæs (Eds), *DRS Cumulus Oslo 2013 - Proceedings of the 2nd International Conference for Design Education Researchers*, *Vol. 1,* 14-17 May, Oslo, Norway (pp. 1369–83). ABM Media. https://doi.org/10.21606/learnxdesign.2013.131

Seitamaa-Hakkarainen, P., Lahti, H., & Hakkarainen, K. (2005). Three design experiments for computer-supported collaborative design. *Art, Design & Communication in Higher Education, 4*(2), 101-119. https://doi.org/10.1386/adch.4.2.101/1

Seitamaa-Hakkarainen, P., Viilo, M., & Hakkarainen, K. (2010). Learning by collaborative designing: Technology-enhanced knowledge practices. *International Journal of Technology and Design Education, 20*(2), 109–136. https://doi.org/10.1007/s10798-008-9066-4

Viilo, M. (2020*). Teacher's orchestration in longitudinal collaborative inquiry process.* Helsinki Studies in Education 77. PhD dissertation. University of Helsinki. http://hdl.handle.net/10138/315024

van der Lugt, R. (2005). How sketching can affect the idea generation process in design group meetings. *Design Studies, 26*, 101–22. https://doi.org/10.1016/j.destud.2004.08.003