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EXPERIENTIAL VALUES AS PROMOTERS FOR EMERGING VIEWS ON SUSTAINABLE DESIGN EDUCATION

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ABSTRACT
This paper explores dynamics between materials use, technical and experiential attributes and experiential sustainability to promote sustainable design in design education.
Sustainable development is commonly referring to three aspects: 'environment', 'economy' and 'equity/ethics'. Artistic design education puts emphasis on experiential values to support, why users acquire, use and keep objects and can thus be used as an approach to sustainable design as a way to understand user's affections towards objects and enhance efficient exploitation of resources used to materialize objects.
The experience is that especially artistic design students find it difficult to work with sustainable development, as it builds on different means than used in the remaining curriculum and learning environment. Consequently it has been proposed to broaden the scope of sustainable design to include experiential concerns in what can be called experiential sustainability.
The paper specifically discusses how this fourth dimension can interact with the conventional understanding of sustainable development to provide materials teaching that prepares students for working with sustainable design linking it to their own practice as students and the practice of artistic design as a whole. The experience of this is that when including 'experience' as a sustainable design approach students increasingly acknowledge the competences they acquire as part of their education as valid for working with sustainable design. Furthermore they find it easier to relate their own practice to environmental, economic and ethical concerns and to propose holistic sustainable design concepts.

Keywords: Artistic design education, materials teaching, sustainable design, experiential sustainability, materials selection.

1 INTRODUCTION

Artistic as well as technical design courses face the challenge of preparing students to navigate in the future design field and here sustainable thinking will be inevitable. However, as sustainable product design has developed in complexity [1], [2] there is a need to re-think what and how students learn. From primarily considering environmental concerns of raw material production and refining processes, sustainable design has developed into embracing product and service systems, business models and strategies as well as increasingly also user experience and cultural behaviour [2], [3]. This means that it has developed from being mainly objective to highly subjective and from considering singular and non-interactive entities to complex and interacting system in continuous flux.
The experience in materials courses is that students find it difficult to relate sustainable thinking to their remaining curricular activities, as the present debate on sustainable development is predominantly focusing on rather quantitative measures such as environmental, economic and ethical concerns known as the Triple Bottom Line. Thus it can be argued that the understanding of sustainable development calls for a reinterpretation of the means used to evaluate approaches that deal with sustainable design. Consequently a Quadruple Bottom Line has been proposed that includes experiential concerns in what can be called experiential sustainability [4]. Experiential sustainability can for example relate to 'aesthetics' [5], 'affections' [6] and 'cultural meanings' [7].
It is however also argued that it is necessary to increasingly link different approaches to sustainable design to ensure that sustainable design remains a holistic discipline with actors from multiple disciplines with different competences and interests. This is necessary because approaches to

sustainable design influence and interact with each other, positively and negatively [8], and future designers need to be able to navigate between different ways to understand and work with sustainable design.
Artistic design education stresses the role of experience, in the ways students are taught as well as in what students should emphasize in their work. However studies show that in materials teaching in design education in general there is a tendency that the relation between the lecturers' competences and students' interests is distorted, as lecturers focus on materials' composition and construction in their teaching, while design students relate materials to previous applications [9]. The different ways to give meanings to materials means that materials teaching risks becoming detached from the remaining curriculum and that students consider formal considerations for materials as something exterior to their primary practice.
In order to increasingly make (artistic) design students and future designers actively relating to materials and sustainable design, emphasis should be put on the aspects of materials and sustainable design that relate to artistic design practice, namely the ways artistic designers work with experience and interactions between human beings and objects and how it is intrinsically linked to ways materials and sustainable design is commonly communicated. This can help students to acknowledge their role in sustainable design using materials as important means to achieve designs that are potentially sustainably beneficial. It further means that students can apply the mindset and value systems that are developed in the design course in their work with materials and sustainable design, making them act more freely as they feel familiar with the learning situation and the way of thinking.

2 A MATERIALS TEACHING METHODOLOGY

This paper builds on a proposed materials teaching methodology developed to facilitate the appreciation and use of physical, experiential and sustainable material considerations [10]. It has further been developed to challenge students' boundaries of what materials are and what they can be used for when working with, communicating and assessing materials to create stronger bonds between the materials use and experience in sustainable design practice. The methodology has been developed for artistic design education, but has shown to be applicable in the wide span of design courses.
The methodology builds on three components, 'materials accessibility', 'materials transparency' and 'materials approachability' and corresponds to progressive cognitive learning models such as Bloom's taxonomy of learning [11].
In the methodology 'materials accessibility' relates to the ways students can access materials by means of physical material samples and appropriated and relevant material information, 'materials transparency' relates to the ways students articulate and communicate materials and how material meanings are translated and 'materials approachability' relates to the systems and structures students apply when considering and choosing materials.
The methodology has departed in two materials courses in an artistic design course for fashion, textiles and industrial design students: an introductory materials course and a materials and sustainability course on respectively second and fourth semester of the undergraduate studies. The first course serves to introduce basic materials and to discuss the role of materials in society, while the second serves to introduce approaches to sustainable design with basis in materials.
The methodology was introduced as a collection of tools and methods activating the three components [10]. However as it has been developed as a methodological framework proposing an overall pedagogical mindset for working reflectively and systematically with materials in design education, tools and methods can be modified and changed to fit specific curricular interests. It is however emphasized that tools and methods should be composed on component that shift back and forth between: reflection / analysis processes, individual / collective mediation of meaning and subjective / objective understandings of materials.

2.1 Working with the materials teaching methodology in practice

As the methodology should not be regarded as a fixed teaching resource, how it works in practice is complex to assess in a simple manner. As a lecturer having taught the same courses for a number of years, the suitability of the methodology is instinctively assessed by students' progress, involvement and dedication in the courses. As it is difficult to formally assess this, instead the methodology will be discussed elaborating on specifically two aspects, namely the methodology's ability to *'create curiosity and familiarity'* and '*create reflection and structure'*.

These aspects both relate to the students' attitude towards materials and in that way share some characteristics. However where *'creating curiosity and familiarity'* relates to students' preliminary encounters with materials, *'creating reflection and structure'* relates to students' long-term interaction with and incorporation of materials in design practice.

2.1.1 Create curiosity and familiarity

A methodology should encourage students' curiosity and ability to explore material based on their own preferences and interests. It is essential not only to create familiarity with the range of physical materials, but also to link materials courses with the remaining curriculum as ways to understand materials. Thus a methodology should emphasize on combining 'engineering' and 'artistic' ways to understand and explore materials. This can strengthen students' output from the materials courses and their future use of materials as an integrated and important part of the design process.

2.1.2 Create reflection and structure

A methodology should encourage students' ability to reflect on and structure materials endeavours to ensure strong and evident materials choices. When learning to reflect on materials and on materials requirements in a given context of use, students are trained in critical thinking and when learning to (formally) structure materials understandings and choices, students get a structure to systematically argue for pros and cons of materials. Lastly, when simultaneously reflecting and structuring students are encouraged to apply inductive-deductive thinking as a way to create coherent meaning.

With the two aspects the methodology emphasizes a multidimensional approach creating links between subjective and objective ways to create meaning and reflective and structured ways obtain and communicate meanings of materials. Thereby different kinds of information become relevant and different ways to obtain and generate information become activated. The methodology prepares students to think *sustainable*, but it is a deliberate choice that the notion is not articulated, as it is believed that the best way for dealing with sustainability issues and incorporating sustainable efforts in design practice, is to ensure that it is properly integrated. Thus students are encouraged to work with sustainable design as a way to build upon and add an extra dimension to the fundamental design practice.

3 ACTIVATING EXPERIENTIAL VALUES IN THE METHODOLOGY

Having established the basis premises for the methodology, focus can shift to particular aspects such as experiential values. In the following three examples of exercises integrating experiential values in the materials curriculum are provided. The examples do not serve to provide a full overview of relevant exercises, but to give some insights in the potentials and challenges.

3.1 Individual material collections

As part of the materials accessibility component, students are asked to establish formal individual material collections based on students' own comprehension on necessary information for his/her practice, but that should acknowledge both physical and experiential aspects. The collection serves to make students reflect on their material knowledge and what kind of material information they use to assess and consider materials. It further serves to provide students with a collection of materials that is appropriated for their individual practices.

In a first step students are asked to formulate a template that embraces this information and that leaves room for a physical material sample. The content of students' preliminary templates is discussed in plenary sessions so students can be inspired by and provide input to each other.

Due to practical circumstances it has not been possible to include examples of the preliminary material collection templates in this paper. It is however possible to discuss, how students approach the task and how their templates develop.

Observing students while working on their individual templates, it is evident that they become inspired, as they have to use their creativity to create meaning of something that can otherwise seem difficult to relate to. Furthermore, they become motivated, as they are encouraged to incorporate the aspects of materials that are relevant for their practice. Because the exercise is given without much instruction, students' preliminary templates demonstrate their immediate thoughts and insights. The freedom they are given to formulate a template for their own needs further make them reflect on the information they find necessary in the present and may find necessary in the future. Students are early

on very aware of the role of sustainability and even though they have not yet had courses relating to the topic when starting to develop their material collections, many students prepare their templates to also include sustainable aspects. Nevertheless, they also recognize the amount of information they need to acquire in order to complete the templates for all materials. Consequently this leads to reflection on the amount of information necessary in a material collection and how this information should be presented to create information depth and yet flexibility in the template.
Through their templates, students demonstrate a plethora of different approaches and thus mindsets when it comes to structuring material information. While some students suggest template dominated by text and somehow 'conventional' categories, others suggest pictographic categories. Furthermore, while some apply distinct values, others apply relative values that make it possible to work with illustrative graphics. The graphics are for examples relative indications on a continuous scale with two well-defined extremes.

3.2 Comparative materials scales

As part of the materials transparency component, the 'comparative materials scales' is an exercise that serves to train students' ability to communicate values and understandings of materials creating correlation between different ways of working with materials and techniques [10].
In groups of four to five, students are asked to order five material samples on a high/low or very/little scale based on a material attribute. The attribute can relate to anywhere on the physical-experiential scale and thus it is necessary for students first to mediate their meanings and understandings of the given attribute in order to have a shared basis for the assessment. To illuminate that attributes are not equally objective/subjective, the scales are made for at least five attributes. When groups of students have made the five scales, all groups' scales are collected in a matrix to be discussed in a plenary session. In figure 1, an example of a comparative scale (left) and a matrix of scales (right) are shown.

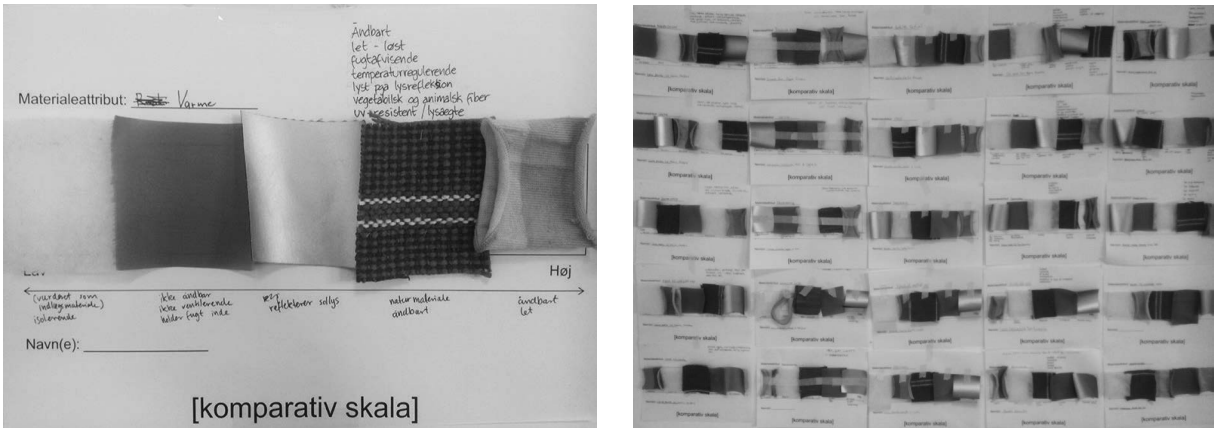

Figure 1 – Left: Comparative material scale for the attribute 'warmth', Right: Matrix of comparative material scales from five groups for the attributes 'associations to Roskilde Festival', 'warmth', 'danceability', 'suitability in windy weather' and 'water repellency' in a materials introduction course for fashion and design students in February 2016.

The exercise embraces two parts that active two cognitive modes. In the first part, where smaller groups of students work together to define a shared meaning of the given material attribute and where materials are ordered according to the definition of the attribute, students are trained in mediating meanings between individual and collective domains (figure 1 – left). In the second part, where students as a large group are asked to discuss, why the material order for some attributes are more/less agreed on than other (figure 1 – right) students need to take a step back and consider the nature of the attributes they are considering.
While students do the exercise, it is evident that they are surprised by the diversity of understandings of attributes and realize how important it is so establish and thus clearly communicate, what an attribute (or requirement) means in a given context. Nevertheless it can be noticed that some students find it very difficult to acknowledge their own meanings as valid for the assessment. The assessment in the exercise is a formal way to triangulate meanings, which is something all people do on a daily basis when comparing things. Thus, it can be argued that students should learn to trust their own meanings, especially as experience with time will create a stronger foundation.

3.3 Identifying requirements in materials selection

As part of the materials approachability component students are asked to identify requirements as a distinct step in materials selection and here be aware, how they relate to physical, experiential and sustainable aspects. Requirements can deliberately be more or less physically, experientially or sustainably oriented, but emphasizing the distribution highlights, how the nature of identified requirements is often distorted compared to the intensions of the material application, namely being more physically oriented as these attributes are the ones used the most and are easiest to compare. Thereafter students are asked to perform a guiding material assessment in a material selection matrix based on the identified material requirements.

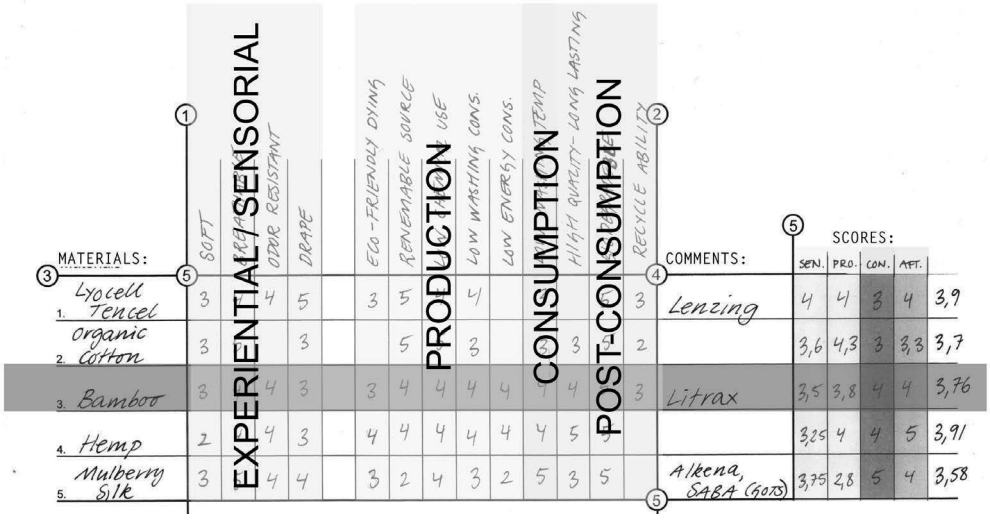

Figure 2: Example of a materials selection matrix with emphasis on experiential/sensorial as well as production, consumption and post-consumption attributes in a sustainable fashion design concept from a materials and sustainability course in March 2015.

In figure 2 an example of a materials selection matrix emphasizing experiential/sensorial and production, consumption and post-consumption attributes is shown. A materials selection matrix is a method to select materials in design with a meta-systematic approach that assesses selected materials based on identified requirements and has been developed to support and frame the methodology [10], [12]. In this example all requirements are assessed jointly, establishing materials selection based on experiential (sensorial) and physical (production, consumption and post-consumption) means. The assessment has been made on a 5-point scale applying a similar approach as in the comparative material scale.

4 DISCUSSION

The methodology has been developed for materials use and integration and thus not specifically for sustainable design, but it can prepare students to work reflectively and structured and thus offer a frame for working with sustainable issues in the future.

Based on experience with the methodology students increasingly incorporate experiential aspects in sustainable design projects and in courses on materials and sustainable design, students not only consider typical approaches such as environmental friendly production, organic raw materials and biodegradable materials, but also approaches such as larger service systems and business models that promote a personal experience and affect the cultural behaviour of using objects. This can be through the shape or construction of an object, through return systems and materials reusability and constructing personal affections to objects through the materials use. This demonstrates that it is possible to activate designerly thinking in materials use in sustainable design and make students use competences they have acquired in other courses, for example methods use, product development, aesthetics and design history as well as practical competences from workshops.

The methodology has been developed to strengthen students' reflective and structural mindset when working with materials and can be regarded as a response to the increasing risk of automated materials choices (also within sustainable issues) based on materials exploration and selection software. The methodology prepares students to navigate within sustainable design, without explicitly putting a

'sustainability' tag on it, which is believed to enhance the chance that students will see it as a way to explore and strengthen their practice focusing on experiential aspects in line with environmental, economic and ethical aspects.
The three exercises included in the paper were specifically chosen, as they can be used to highlight, how exercises can work together and thus can emphasize the importance of well thought out methodologies used in materials teaching and how it can influence students' ability and motivation to work with inevitable topics such as *sustainability*.

5 CONCLUSION

The paper has discussed the role of experiential values as promoters for sustainable design education based on experiences in an artistic design education. Centred on a materials teaching methodology using the components 'materials accessibility', 'materials transparency' and 'materials approachability' emphasis is put on providing tools to 'create curiosity and familiarity' and 'create reflection and structure' as means to support experiential values in materials teaching.
The methodology is exemplified by three exercises that in different ways elaborate on the necessity of experiential aspects, how they interact with physical aspects and how this interaction can strengthen working with sustainable issues in design practice.
The experience is that students increasingly acknowledge the competences they acquire as part of their education as valid for working with sustainable design. Furthermore they find it easier to relate their own practice with environmental, economic and ethic concerns to propose holistic sustainable design concepts.

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