

POST- USE DESIGN THINKING  
FOR PRODUCT DESIGN PROCESS AND SUSTAINABILITY  
A STUDY ON AN EDUCATIONAL PROJECT IN GLASS PACKAGING

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FOR PRODUCT DESIGN PROCESS AND SUSTAINABILITY  
A STUDY ON AN EDUCATIONAL PROJECT IN GLASS PACKAGING**

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## **ABSTRACT**

### **POST- USE DESIGN THINKING FOR PRODUCT DESIGN PROCESS AND SUSTAINABILITY A STUDY ON AN EDUCATIONAL PROJECT IN GLASS PACKAGING**

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The rapid disposal of products has detrimental effects on environment which is increasing resource consumption for the production of new products, along with the waste production. Therefore, designing long lasting products has great importance for achieving sustainable consumption and production. The present study analyzes the implications of an approach called post-use design thinking for achieving sustainable consumption and production through product longevity. To explore that approach, two educational industrial design projects are analyzed throughout the study. The results suggest that post-use design thinking should be considered at the early stages of the design process. The idea generation exercises developed specifically for this design thinking seem to be helpful in generating design solutions for post-use phase. The results also indicate that the post-use design thinking is feasible in terms of design and production for glass packaging products, which is the specific case analyzed throughout the research.

Keywords: post-use design thinking, sustainable consumption and production, design process, design for sustainability, product longevity

## ÖZ

# ÜRÜN TASARIM SÜRECİ VE SÜRDÜRÜLEBİLİRLİK İÇİN KULLANIM SONRASI TASARIM DÜŞÜNCESİ CAM AMBALAJ ALANINDA YAPILAN BİR EĞİTİM PROJESİ ÜZERİNE BİR ÇALIŞMA

Coşkun, Aykut

Yüksek lisans, Endüstri Ürünleri Tasarımı Bölümü

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Ürünlerin hızlı bir şekilde doğaya atılması, yeni üretilecek ürünler için doğal kaynakların tüketilmesi ve atılan ürünlerin doğada biriken atık miktarının artırması gibi çevre üzerinde bazı olumsuz etkilere yol açabilir. Bu nedenle, uzun ömürlü ürünler tasarlamak sürdürülebilir tüketim ve üretim amacına ulaşmak için büyük önem taşımaktadır. Bu çalışma ürünlerin sonraki kullanımı düşünerek tasarlanması düşüncesinin sürdürülebilir tüketim ve üretim açısından etkilerini araştırmaktadır. Bunun için de endüstri ürünleri tasarımı alanında yapılmış iki eğitim projesini incelemektedir. Çalışmanın sonuçları bu tarz bir düşüncenin ürün tasarımı sürecinin erken aşamalarında yer alması gerektiğini ve bu tasarım düşüncesi için özel olarak geliştirilmiş fikir geliştirme egzersizlerinin, kullanım sonrası için fikir geliştirme konusunda faydalı olduğunu göstermektedir. Buna ek olarak, bu çalışma ürünlerin kullanım sonrası dikkate alınarak tasarlanması düşüncesinin cam ambalaj ürünleri alanında tasarım ve üretim açısından uygulanabilir olduğunu göstermektedir.

Anahtar kelimeler: kullanım sonrası tasarım düşüncesi, sürdürülebilir üretim ve tüketim, tasarım süreci, sürdürülebilirlik için tasarım, uzun ömürlülük

*To my family*

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## CHAPTER 1

### INTRODUCTION

We assume that everything's becoming more efficient, and in an immediate sense that's true; our lives are better in many ways. But that improvement has been gained through a massively inefficient use of natural resources.

Paul Hawken

(as cited in Gelder, 1995, p.19)

Technology has made and been still making invaluable contributions to our society through increasing our quality of life and making our lives better. However, it has to be taken into consideration that everything has a cost. To establish the present society, we have been using the natural resources as if they are infinite. However, it has been realized that the resources of the planet earth are not infinite and the humankind jeopardizes the well-being of future generations through consuming the planet's resources. In the second half of the twentieth century, it was more often pronounced that the technology had detrimental implications on the environment. However, that is not to say that the technology itself is the underlying problem or is against the nature. On the contrary, in addition to its negative effects on the nature in terms of how it is used, the technology provides us with valuable opportunities to struggle with the environmental degradation. Since the 60s, the negative implications of the technology for the environment have been investigated with increased attention by many parties such as governments, institutions, academics, practitioners etc. It is clear that solutions for preventing or minimizing the negative implications of our means of using the technology for the environment are worth exploring. In other words, any contribution made would be invaluable for the present and the future state of our society.

The environmental problems which we encounter today originate from the way we design, produce and use the products (i.e. referring to buildings, consumer products). For instance, when a company decides to produce a kettle for domestic use, firstly interdisciplinary design teams develop design ideas and concepts for the kettle followed by the development of these initial solutions further. For the production of this kettle, the company uses various raw materials either extracted from the nature or made artificially in some facilities. After the production phase,



the kettles are distributed to the various markets for consumers to purchase and use in the kitchen. However, this is not the end phase for the kettle's lifespan. When consumers are dissatisfied with that version of it for various reasons (i.e. product obsolescence) they simply want to get rid of or throw away the product.

Considering the whole lifecycle of the kettle, we might assume that in all of the phases we consume energy along with the natural resources. At this point, the field of industrial design may play a central or crucial role in preventing the negative implications of the design, production, distribution, use and disposal of the products, since the product development phase is placed at the top of the whole process where the initial ideas lead to the design and production of the products. Hence, it is prominent that we should reconsider or rethink the way we use the resources, the way we design, produce and distribute the products, and the way we use and dispose of them.

## **1.1 Problem definition**

In our consumer society, products appear to be discarded rapidly and replaced by new ones. The rapid disposal of products has two major damaging effects on the environment. Firstly, it may lead to a rapid increase of waste, unless discarded products and their parts are recovered and repaired by the producers and users. Secondly, discarding of products results in the replacement of those products with new ones or a rapid increase in the demand for new products for which the producers use additional raw materials and energy to produce. Therefore, designing long-lasting products might have a crucial role in achieving sustainable consumption and production. The main question is *how industrial design could contribute to the product longevity or to the development of enduring products which users want to keep for a long time.*

To explore the potential contribution of design to product longevity and the notion of sustainability, an approach called 'post-use design thinking' was investigated throughout the research.

The "post-use design thinking" attempts to integrate the potential post-use design solutions into the early stages of the product design and development process through enabling products to be reused after fulfilling their initial use phase. This design thinking also embraces user involvement in transforming the products into the new ones, thus it suggests enduring products which users want to keep for a long time. Consideration of the post-use solutions during the

idea generation phase would result in products which could have relevant design details enabling and encouraging users to be involved in transforming the products into new ones or new contexts. Hence, the post-use design thinking might be a promising approach for sustainable consumption and production, as it suggests not only “new” products created with minimum resources, but also “emotionally durable” products which users desire to keep for a prolonged time (Chapman, 2005, p.18).

## **1.2 Aim and objectives of the study**

Raising the question in the field of industrial design in terms of sustainability, the current research aims to investigate how the post use design thinking would be integrated into early stages of the design process, and what the implications of the integration of this design thinking would be for the design process. In doing so, the present research explored two educational industrial design projects carried out in the Department of Industrial Design at Middle East Technical University (METU). The projects were specifically developed by the ID 301-302 course tutors for integrating the post-use design thinking at the early stages of the design process. Therefore, the research also aims to reveal the outcomes of these design projects developed by the third year industrial design students.

## **1.3 Research questions**

- What would be the implications of the integration of the “post-use design thinking” into the early stages of the design process (i.e. idea generation phase)?
- How would the specific idea generation strategies developed for the design projects (i.e. idea generation exercises) help the students to generate ideas for the post-use phase?
- What would be the design considerations for the use and the post-use phases of the products analyzed throughout the study (i.e. water bottles and candle jars)?
- What would be the potential use and post-use design solutions for these products (i.e. water bottles and candle jars)?
- From designers’ and manufacturers’ viewpoint is “post-use design thinking” possible or feasible in terms of theory and practice?

## **1.4 The structure of the thesis**

The thesis includes six chapters:

Chapter 1 begins with a brief introduction, presents the problem definition, aim and objectives of the study, and poses the research questions.

Chapter 2 presents the literature review findings. The literature review begins with explaining the environmental issues regarding sustainability, and continues with the definition of key concepts such as sustainable development, sustainable consumption and production and design for sustainability. The literature review also includes a brief section explaining design education for sustainability. After mentioning the approaches for sustainability, design-focused approaches for sustainability are explained in detail. This is followed by the information on current approaches to product longevity and increased product life spans. This chapter concludes with the definition of the “post-use design thinking”, explanation of the key concepts related to this design thinking along with the product examples illustrating this design thinking further.

Chapter 3 summarizes the methodology for the research through focusing on qualitative research methods. In particular, in this chapter semi-structured interviews and content analysis will be presented. This chapter also includes the structure of the research conducted for the study including preliminary study and primary research.

Chapter 4 is mainly about the preliminary study focusing on the first project (namely Project 1) carried out in the Department of Industrial Design at METU. This chapter includes the description and the phases of the Project 1, and it concludes with the conclusions from and insights into the preliminary study along with the examples from the outcomes of the Project 1.

Chapter 5 includes the primary research focusing on the second project (namely Project 2) related to the post-use design thinking carried out in the Department of Industrial Design at METU. The chapter begins with brief overview about the current state of glass packaging in Turkey in terms of sustainability and its relevance to the concept of post-use. Chapter 5 includes the description and the phases of Project 2, and the project outcomes along with the conclusions from the interviews. The interview results include insights from the ID students and Anadolu Cam Sanayii A.Ş. (i.e. the collaborative firm contributing to the Project 2). The interview results and conclusions for each student along with the results of the interviews with Anadolu Cam Sanayii A.Ş. are presented. This chapter concludes with overall conclusions for the Project 2 and primary research.

Chapter 6 presents and summarizes the conclusions and findings from the preliminary study and primary research by revisiting the research questions. It also includes a brief discussion of design research process and the implications for future research.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

The humans depend on the nature, as they need the natural resources for the fulfillment of their basic needs such as food, shelter, security etc. Since their first existence on earth, the humans has benefited from the nature through consuming the natural resources with an increasing rate for their growth, well-being and development. However, the humans have realized that the resources are not infinite and through the rapid consumption of the natural resources, the well-being of future generations appears to be at great risk. Benyus (1997) addresses the problem that the way we use resources and materials is putting in danger the well-being of the future generations:

When we objectively view the recent past – and 200 years is recent even in terms of human evolution – one fact becomes clear: the industrial revolution as we now know it is not sustainable. We cannot keep using materials and resources the way we do now.

(Benyus, 1997, p. 238)

The current consumption and production processes have negative implications for the environment, including resource consumption and the excessive waste. In the conventional industrial model, the products are created and materialized within a linear process including extraction, production and distribution phases, which can also be extended by adding the disposal phase. After extraction of the raw materials from the environment, these resources are transformed into the products. After the production phase, these products are distributed to the relevant markets. During extraction, production, distribution and disposal, the resources are consumed, and the waste is created in each phase. Moreover, after the products fulfill their initial functions (i.e. complete their useful lifetime), they join the waste stream. To illustrate this, every tone of consumer waste has also generated 5 tones of manufacturing waste and 20 tones of resource extraction waste (Meadows et al., 1992).

Ecological footprint analysis reveals that humanity's demands for the natural resources already exceed the limit that the nature can sustain. The researchers found that the bio-capacity of the

earth was not adequate for the ecological footprint of humanity in 2005<sup>1</sup> and to sustain its consumption, the humanity used the equivalent of 1.3 Earth (Ewing et al, 2008). Considering the findings of the ecological footprint analysis, the emergent problem seems to be vital for the well-being of humanity. Therefore, it is essential that we should re-consider or re-think the way we use the natural resources, as well as the way we design and produce products. In doing so, sustainable solutions considering the social, environmental and economical aspects of our well-being should be explored further. Consequently, the challenge of creating a sustainable world has not been an ideal or utopia; instead it has become a necessity (Margolin, 1998).

## **2.2 Sustainable development**

Within the last three decades, the environmental issues and sustainability have been explored with increased attention. It was 1987 that the term sustainable development and its significance had been first revealed to the world with the report, “Our Common Future” prepared and published by the World Commission on Environment and Development (WCED). In this report the sustainable development is defined as “the development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (p.43). Following this seminal report, the Earth Summit (i.e. United Nations Conference on Environment and Development) was held in Rio de Janeiro in 1992. The conference revealed 27 principles regarding sustainable development. Some significant principles are as follows:

- The developmental and environmental needs of present and future generations must be fulfilled fairly.
- Environmental protection shall be integral to the development process to achieve sustainable development.
- In order to achieve sustainable development and superior quality of life, unsustainable patterns of production and consumption should be decreased
- The institutions should internalize their environmental costs through considering that they should accept or tolerate the cost of pollution.

(Rio declaration on environment and development, 1992)

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<sup>1</sup> In 2005, humanity's total ecological footprint worldwide was 17.5 billion global hectares (gha); with world population at 6.5 billion people, the average person's footprint was 2.7 global hectares. But there were only 13.6 billion gha of biocapacity available that year, or 2.1 gha per person. (Ewing et al, 2008).

Considering the principles above we might conclude that, sustainable development requires the fulfillment of both the present and future generations' needs, the view of environmental stewardship being integral to the development process along with sustainable patterns of consumption and production, and responsible companies (or institutions) taking responsibility of their actions towards the environment.

### **2.3 Sustainable production and consumption**

Unsustainable patterns of production and consumption should be rethought to achieve sustainable development and a higher quality of life for all people (Rio declaration on environment and development, 1992). In other words, sustainable consumption and production is essential and a prerequisite to achieve sustainable development. Sustainable consumption can be defined as follows:

The use of services and related products which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life-cycle so as not to jeopardize the needs of future generations.

(as cited in UNEP, 1999, p. 2)

To explain sustainable consumption and production further, the terms "efficiency" and "sufficiency" are explained. As described by Reisch and Scherhorn (1999), "while efficiency largely depends on technical innovations as well as on an eco-design of products, sufficiency relies on individual behavioral changes as well as on social innovation" (p. 678). It can be said that the efficiency solutions mainly focuses on the production aspect of sustainability, whereas the sufficiency solutions mainly focuses on consumption aspect of sustainability. Till now, the efficiency solutions have been investigated, and some of the solutions such as eco-efficiency<sup>2</sup> have been adopted by many companies to confine the environmental performance of their overall production systems (Fiksel, 2009). However, evidence indicates that the efficiency solutions may not be adequate to achieve sustainable production and consumption. For instance, although many appliances have significant efficiency improvements, electricity consumption was increased by 14% between 1974 and 1994 in the Netherlands (OECD, 2002a). This increase in the electricity consumption can be explained through a term "*rebound*

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<sup>2</sup> The World Business Council on Sustainable Development (WBCSD), defines eco efficiency as "delivery of competitively priced goods and services that satisfy human needs and bring quality of life while progressively reducing environmental impacts of goods and resource intensity throughout the entire life cycle." (WBCSD,2000, p. 9)

*effect* whereby any additional environmental space created by resource efficiency is immediately offset by additional consumption” (Porrit, 2005, p.59). Users may have a tendency to turn on the lights in daylight, since their bulbs are more efficient (consuming less energy), assuming that they would pay less for electricity. Thus, increased consumption can offset the positive effects of efficiency. This suggests that, the sufficiency solutions focusing on sustainable modes of consumption and exploring individual behavior changes need to be investigated further for addressing sustainable consumption and production in terms of both theory and practice.

To achieve sustainable consumption and production each phase of the product life cycle should be considered. The product life cycle may contain extraction of raw materials, design and production, packaging and distribution, use and maintenance, and re-use and recovery. Considering the life cycle of a product, it can be concluded that design has been placed at the very beginning of the process. That is to say, the decisions made in the design process would have a great influence on the whole product life cycle. This brings about great responsibility for designers, since their decisions can also have negative implications for the environment, people and economy. Victor Papanek highlighted this responsibility:

Today, industrial design has put murder on a mass-production basis. By designing criminally unsafe automobiles that kill or maim nearly one million people around the world each year, by creating whole new species of permanent garbage to clutter up the landscape, and by choosing materials and processes that pollute the air we breath, designers have become a dangerous breed.

(Papanek, 1985, p. preface)

However, design can also contribute to sustainable patterns of consumption and production due to its influential role in the product lifecycle. Since design and development process are at the very beginning of product lifecycle, any modification or improvement considered in the design process can lead to rewarding and effective contributions to decrease detrimental effect of products on the environment. Furthermore, design brings together information from various disciplines, and the design process itself is a reflective process (Fletcher et al, 2001). Through design, conceptual and innovative solutions can be transformed into tangible products or services, implying that design can make connections between theory and practice. Due to its ability to make connections between theory and practice (between ideal and real) and its influential role in production and consumption, design as a reflective process can have a significant role to achieve sustainability. Therefore, “an effective manifesto for sustainable consumption can also be seen as a manifesto for design” (Fletcher et al, 2001, p.223).



## 2.4 Approaches to sustainable consumption and production

The approaches to and tools for sustainable consumption and production are summarized in Table 2.1 and Table 2.2. It appears that there is a vast amount of approaches to achieve sustainable consumption and production. The approaches presented here are the ones that are related to product design which are worth mentioning within the scope of this study (e.g. biomimicry, cradle to cradle etc.). All of the approaches are presented with a brief explanation. The emphasis here will be on design-based approaches which will be explained in detail within the next section.

Table 2.1: Approaches to sustainable consumption and production

<p><b>Biomimicry</b> Biomimicry is an approach inspired by the nature through examining its systems and processes in order to develop environmentally friendly solutions to human problems (Benyus, 1992).</p> <p><b>Cradle to cradle</b> Cradle to cradle approach emphasizes the idea that “waste equals food” (McDonough, &amp; Braungart, 2002). This implies that waste becomes resources (i.e. refurbished product parts) for the production processes. It includes the separation of materials into biological and technical nutrients each of which has their own close loop cycles within industrial and natural systems (McDonough, &amp; Braungart, 2002).</p> <p><b>Design explorations for sustainability</b> Design explorations based on the re-contextualization of the objects investigate the compromise of various polarizations such as “ old and new, valued and unvalued, craft and mass-production, custom and standard, local and global, and diversity within unity” (Marchand &amp;Walker, 2007, p.4). Through transforming the objects and changing their context over time, design explorations offer a new understanding of newness.</p> <p><b>Design for behavior change</b> Design for behavior change explores the ways to influence consumer behavior through design in order to achieve sustainable consumption. The strategies for behavior change include eco-feedback<sup>3</sup> (Lilley et al,2005), behavior steering<sup>4</sup> (Jelsma &amp; Knot, 2002) and intelligent products and systems (Lilley et al, 2005)</p>
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<sup>3</sup> Eco-feedback includes solutions which inform users of their impact in an attempt to persuade them to modify their behavior ( Lilley et al, 2005)

<sup>4</sup> Behavior steering includes the products or systems that contain “scripts” or prescriptions for use to encode the designer’s use intention (Lilley et al, 2005).

Table 2.1 (continued)

**Design for environment**

Design for Environment includes creating products and processes addressing the sustainability objectives (such as environmental protection, human health and safety, and sustainability of natural resources) throughout the whole product and process life cycle. (Fiksel, 2009)

**Droog Design**

Droog Design, a conceptual design company founded in 1993, challenges the present material culture through experimental product designs. Their experimental work includes objects produced through using advanced materials with the combination of high tech and low tech small-scale production methods (Ramakers et al, 1998).

**Eternally Yours**

Eternally Yours is formed by a group of Dutch industrial designers. Emphasizing that common approaches for sustainability (e.g. eco-design) are not sufficient, Eternally Yours deals with the question how design can contribute to the elongation of 'psychological lifespan of the products' (Verbeek et al, 1998).

**Integrated Scales of Design and Production for Sustainability (ISDPS)**

Integrated Scales of Design and Production for Sustainability (ISDPS) offers 'integrated thinking' across the product life spans including product design, production, use, post-use and disposal. 'Integrating thinking' proposes an integration of mass-produced components with locally produced parts, and local services for product reuse, repair and recovery along with locally appropriate design and research (Dogan, 2007).

**Natural Step**

Natural Step, a non-profit organization founded by Karl-Henrik Robert, has developed four system conditions of sustainability that lead towards a more sustainable society. Four system based issues that the nature would not be subjected to in a sustainable society are: excessive use of natural resources, increasing amount of toxic materials, increasing environmental degradation, and people's inability to meet their needs (Robert, 2002).

**Product service systems (PSS)**

A product service system (PSS) is a business innovation strategy where products are replaced by systems of products and services which are capable of fulfilling the consumers' needs and preferences. The PSS solutions have higher added value and a smaller environmental impact as compared to existing products (Manzini et al, 2002).

**Slow Design**

Slow Design is a fairly new approach for sustainable consumption where "slow" is an antidote to 'fast' referring to our current industrial world where the rate of the resources' flow is high. In other words, "slow design" is seen as an offset to the existing design paradigm of "fast design" (Fuad-Luke, 2004). It is "an approach that encourages a slower, more considered and reflective process, with the goal of positive well-being for individuals, societies, environments and economies" (Fuad-Luke, 2009, p.22).

Table 2.1 (continued)

<p><b>Sustainable Everyday</b> Sustainable everyday deals with the future scenarios for urban life through investigating what might the everyday life be like in a sustainable society. Sustainable Everyday presents scenarios about ways of life and criteria of well-being which are presented as potentially significant steps in the direction of sustainability (Manzini &amp; Jegue, 2003).</p> <p><b>Sustainable by Design</b> Sustainable by Design challenges conventional means of designing and producing, and our understanding of aesthetics through design explorations. These explorations include the experimental designs of everyday functional objects produced through the combination of mass produced parts with locally produced components, reused objects and recycled materials (Walker, 2006).</p>
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Table 2.2: Tools and methods for sustainable consumption and production

<p><b>Life Cycle Analysis (LCA)</b> LCA is the calculation of the environmental impact of a product or a system throughout its whole life cycle including product design, production, distribution, use, maintenance, re-use, and recycling (Tischner et al, 2000).</p> <p><b>Factor 4, and Factor 10</b> Factor 4 (Weizsäcker et al, 1997) and Factor 10 (Svithmidth-Bleek, 1999) are tools for eco-efficiency where the number indicates the level of the improvement in the productivity along with environmental performance of goods and services.</p> <p><b>Ecological Footprint</b> The Ecological Footprint is the measurement of “the amount of biologically productive land and water area required to produce all the resources an individual, population, or activity consumes, and to absorb the waste they generate, given prevailing technology and resource management practices” (Ewing et al, 2008, p.3-4).</p> <p><b>Design for disassembly</b> Design for disassembly is a method of designing products which can be disassembled at minimum cost and effort at its end of life so that the parts can be recovered (Fiksel, 2009).</p> <p><b>Eco-efficiency</b> WBCSD (2000) defines eco-efficiency as “creating more value with less impact or doing more with less” (p9). It includes the combination of the delivery of products and services with increased quality and with the reduction in environmental impacts occurred during production, distribution, use and disposal (WBCSD, 2000).</p>
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## 2.5 Design focused approaches for sustainability

### 2.5.1 Droog Design

Droog Design, a conceptual design company founded in 1993, challenges our current material culture through experimental product designs. Their experimental works include objects produced through using advanced materials with the combination of high tech and low tech small-scale production methods (Ramakers et al., 1998). According to Ramakers (2002), the underlying philosophy behind the Droog objects is the famous dictum of Mies Van der Rohe, “Less is more”. This implies that the products should be designed as simple as possible so that they (experimental designs) can address the notion of sustainable consumption and production.

The milk bottle lamp, designed by Tejo Remy (1991), can be a good example for Droog products addressing issues related to sustainable consumption and production (Figure 2.1). This product consists of twelve re-used and re-furbished milk bottles and electrical components such as cables and lamps (Ramakers et al., 1998).



Figure 2.1: Milk bottle lamp, designed by Tejo Remy (reproduced from Ramakers et al., 1998)

Another example is the Urn vase, designed by Hella Jongerius (1995), which contains many scratches and bubbles, and traces of its manufacture (e.g. mounding joints) on its surface

(Figure 2.2). Any additional scratches would not degrade the way it looks. Unlike the products with shiny surfaces which are subject to become old-fashioned within a short time, Urn vase challenges our understanding of 'new' and 'old'. Although the use of polymer for the base material of the vase seems to be questionable in terms of sustainability, since the material is not a sustainable alternative for such a product, Droog Design proposes an original point of view to the notion of sustainability through their experimental design criticizing our current consumption activities and production methods.

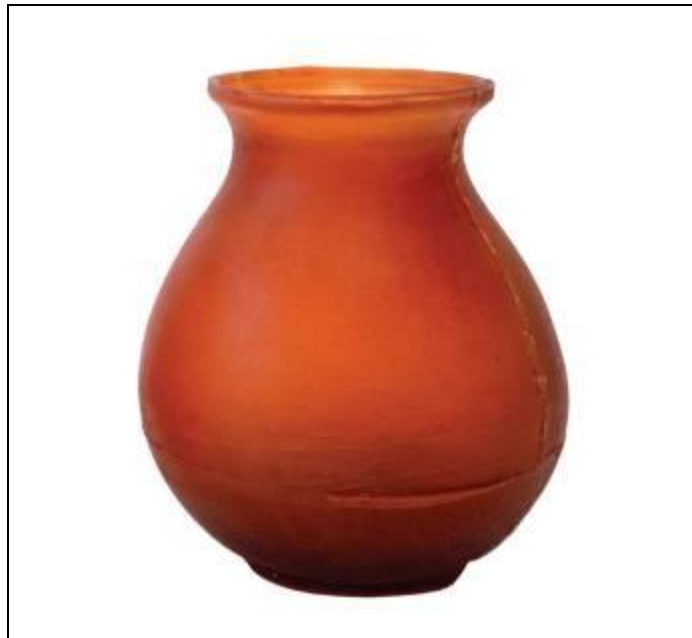


Figure 2.2: Urn vase, designed by Hella Jongerius  
(downloaded from [www.droog.com/products/accessories/urn-vase---brown/](http://www.droog.com/products/accessories/urn-vase---brown/))

### **2.5.2 Design Explorations for Sustainability**

Design explorations for sustainability include objects developed through re-contextualization of the objects, and they investigate our understanding of such issues as old and new, valued and unvalued, craft and mass-production, custom and standard, local and global, and diversity within unity (Marchand & Walker, 2007). Walker (2007) proposes a "research through design" approach for sustainability where designers become researchers at the same time, and use the

act of designing as a research method. In other words, design is used for developing and improving theoretical ideas through design explorations.

The work of Marchand and Walker (2007) includes:

The design approaches that utilize aesthetic mechanisms or devices that allows out-of-date products to move from unvalued rubbish to valued, durable, and sustainable object solutions that have the possibility to evolve over time (p.4).

The primary emphasis of the design explorations that they make is the creation of “family of objects” through re-contextualization of objects (Marchand & Walker, 2007, p.5). The examples include an intervention (i.e. the application of a permanent red dot) to the diverse drinking glasses to create a new context around these discarded glasses, and transform them into a “family of products” (Figure 2.3). A second example is the family of objects created through a red coating applied to various cutlery pieces (Figure 2.4). In both product examples, design interventions create new contexts enabling objects to be re-contextualized and re-valued (Marchand & Walker, 2007).



Figure 2.3: Red dot on drinking glass (reproduced from Marchand, 2008)



Figure 2.4: Cutlery pieces with red handles (reproduced from Marchand, 2008)

The decrease in the value of a product can lead users to discard the product. Through applying various interventions to the products, which are discarded due to decrease in their value, these design explorations attempt to explore design's contributions to the development of enduring, and meaningful artifacts (Marchand & Walker, 2007). Hence, creating new contexts around such objects can have a great importance to achieve sustainable consumption and production.

### 2.5.3 Eternally Yours

We began to understand that 'making a product last long' is different from 'making a long lasting product': It requires effort and keeps on doing so, not just for designers but also for marketers, communication specialists, financial experts, service providers and of course users and owners.

(Van Hinte, 2004, p.53)

It is clear that the rapid disposal of products due to product obsolescence harms the environment through increase in the waste production and resource consumption. Therefore, products with long life spans may provide valuable opportunities for the reduction of environmental impacts.

Eternally Yours, a group of Dutch industrial designers, seeks ways to elongate the product life spans and investigates how design can enable this. The group has determined mainly four possible directions towards sustainable consumption and production, which are: a shift from

products to services, eco-design, re-cycling and re-using, and finally elongating the “psychological life spans” of products (Verbeek et al., 1998, p.30). The psychological life span of the products implies that the life span of a product is over when the user has no longer want to use or maintain this product even though it still functions properly (Muis, 2006).

Users may discard their products when they are broken and worn out, and when they become out of date, and no longer reflect their preferences. Products can also be discarded when their psychological life span is over, and thus Eternally Yours endeavors to prolong the psychological life span of the products through creating a bond between products and users (Verbeek et al., 1998).

#### **2.5.4 Integrated Scales of Design and Production for Sustainability (ISDPS)**

At the regional or local levels, the resources are limited in terms of the availability of materials, and production techniques, which may hinder the potential maintenance, repair or upgrade solutions to be applied at the local level. Therefore, combining the mass produced component parts with locally produced ones can have a great importance to overcome such problems for the notion of sustainability and product design.

The concept of ISDPS offers ‘integrated thinking’ across the product life spans including product design, production, use, and post-use. ‘Integrating thinking’ proposes an integration of mass-produced components with locally produced parts, and local services for product reuse, repair and recovery along with locally appropriate design and research (Dogan, 2007). The introduction of greater ‘localization’ in the design, manufacture and post-use of the products is central to the ISDPS concept where the term ‘localization’ refers to design solutions for diverse user preferences and needs at the batch production scale, and post-use services at the local and regional levels including repair, reuse, recovery and refurbishment (Dogan, 2007).

In order to explore the concept of ISDPS, Dogan (2007) presents various design explorations developed and produced through bringing together locally made parts with mass-produced components. For instance, “Mat lamp” (Figure 2.5.) uses mass-produced, off the shelf lamp and fittings along with a bamboo tablemat wrapping around the wire armature. The table mat can be replaced by locally available materials such as papers, fabrics etc.





Figure 2.5: Mat lamp by Cagla Dogan (reproduced from Dogan, 2007)

Dogan (2007) argues that:

This concept not only reduces negative environmental effects and addresses locally focused socio-economic needs through product production, but also encourages product caring, maintenance and recovery at the local and regional levels (p. 20-21).

Product longevity and localization have great importance to address sustainable consumption and production. Therefore, it is not surprising to say that achieving product longevity with post-use services offered at the local level, and the combination of this local production with the mass-production in order to satisfy local needs and preferences can make significant contributions to the notion of sustainable consumption and production.

### 2.5.5 Sustainable by Design

If we begin to create long-lasting, but repairable and upgradeable products made from reused materials and parts, we will have to reassess our ideas of products and the value and place of the 'new', the glossy and the perfect.

(Walker, 2006, p. 81)

Walker (2006), through various design explorations, challenges our conventional ways of designing and producing, and our understanding of aesthetics in order to create a material culture which is not only environmentally and socially responsible but also aesthetically expressive. His approach embraces the experimental everyday functional objects which are produced through creative design activities. These experimental objects lead us to reconsider the scales of production, social responsibility and use of natural resources and also challenges our traditional ways of understanding of aesthetics (Walker, 2006).

The design explorations focus on various principles associated with sustainable consumption and production. "The inventiveness of necessity" includes new solutions, such as the arc lamp below (Figure 2.6), requiring minimum use of resources to fulfill a need (Walker, 2006, p. 81). In other words, it aims to design and produce an object in a way that requires minimum resources and energy to produce it.



Figure 2.6: Arc Lamp (reproduced from Walker, 2006)

At the local level the resources are limited in terms of materials and production processes. It can provide opportunities to reconsider the nature of our objects, and thus “improvisation and spontaneity” can create sustainable alternatives (e.g. kind of blue chair in Figure 2.7) to the everyday objects produced through available resources at the local level (Walker, 2006, p.84).



Figure 2.7: Kind of blue chair (reproduced from Walker, 2006)

Another principle that Walker (2006) focuses on is “aesthetic longevity” (p.87). The shiny surfaces make products vulnerable to become old with small scratches on their surfaces, and make them discarded due to users’ dissatisfaction. However, rough surface finishings (e.g. cable radio in Figure 2.8) can allow surface to age gracefully and contribute to aesthetic longevity as a dimension of sustainability (Walker, 2006).



Figure 2.8: Cable radio (reproduced from Walker, 2006)

Furthermore, local manufacturer for the “integration of scales” plays also a significant role for sustainable consumption and production (Walker, 2006, p.93). In his work, all of the design explorations can be produced through available resources at the local and regional levels, which makes them sustainable alternatives to everyday functional products. The integration of scales includes the combination of mass-produced component parts with locally produced parts (e.g. Lumière Floor Lamp in Figure 2.9). Because of the limited resources at the local level, many standard components are produced at the mass production scale. However, the post-use services appear to be more viable at the local level. Therefore, bringing these together becomes more effective for sustainable product design (Walker, 2006).



Figure 2.9: Lumiere floor lamp (reproduced from Walker, 2006)

Consequently, these experimental objects, designed and produced through considering the principles mentioned above are worthwhile, since they inform to a great extent both theory and practice of sustainable product design.

## 2.6 Design for sustainability

Within the last three decades the integration of environmental issues into our production and consumption systems have been incorporated in the various approaches for sustainability such as *green design* (1980s) and *eco-design* (1990s). These initial but influential approaches have been followed by *design for sustainability* within the last decade. Although the definition of design for sustainability is evolving, it requires that companies incorporate the environmental, social and economical aspects of sustainability (triple bottom line<sup>5</sup>) throughout the whole lifecycle of a product (Crul et al., 2007). Design for sustainability seems to be a broader concept than eco-design as it extends the key elements of eco-design (i.e. economical and ecological

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<sup>5</sup> Triple bottom line includes the key elements of design for sustainability which are profit (economical), people (social) and planet (ecological) (Crul et al, 2007)

aspects of sustainability) to triple bottom line through integration of socio-cultural aspects of sustainability, and currently to quadruple bottom line including the notion and incorporation of personal meaning (Walker, 2009).

Design for sustainability has mainly, within a wide spectrum, focused on both *consumption* and *production* with a particular emphasis on environmental stewardship, economic viability and socio-cultural well-being. On the one hand, the attempts to explore sustainability in terms of design have mainly emphasized the production aspect of design along with resource acquisition, energy use and product distribution (Fiksel 2009, Vezzoli & Manzini 2008, McDonough & Braungart 2002, Birkeland 2002, Charter and Tischner 2001). On the other, the studies on sustainable consumption have examined the role of users by focusing on user behavior and with a special emphasis on the use phase of products (i.e. mostly electronics) (Lilley 2007, Bhamra & Lofthouse 2007, Chapman 2005, Fletcher et al., 2001, Sherwin & Bhamra, 1998). As the consumption might be the key to incorporate sustainability into the product design and development process, this needs to be explored further to gain insights into both theory and practice, which in fact simultaneously inform each other.

To incorporate design for sustainability various strategies could be implemented, and Fletcher et al. (2001, p.215) categorized these as follows:

- Product focus — making existing products more resource efficient
- Results focus — producing the same outcome in different ways
- Needs focus — questioning the need fulfilled by the object, service or system, and how it is achieved

Thus far, among these strategies, efforts to address design for sustainability mainly focus on making existing products more resource efficient. However, the end products designed and manufactured through 'product focus' approaches are generally similar to the existing product design solutions (Walker & Marchand, 2007). In other words, except being resource or energy efficient, these products appear to be almost the same as the previous ones (i.e. with similar features like shiny surfaces making them out of date after a short period of time). Thus, the 'product focus' approaches do not challenge our current conception of design in order to prolong product life spans, particularly in terms of product-user relationships. In addition to that, such 'product focus' approaches mainly give importance to alleviate the after affects (or symptoms), rather than concentrating on actual causes of the problems (Chapman, 2005). For instance, electronic waste (i.e. discarded mobile phones, personal computers etc.) is a result of a transitory relationship between products and users. Thus, attempts to recover the electronic

waste through recycling strategies are only emphasizing on reducing the effects (symptoms), which do not raise the questions about the actual causes of electronic waste (e.g. why consumers discard such products rapidly). Therefore, it might be required that besides making existing products more resource efficient, new solutions should be explored to incorporate sustainability into the product design and development process. Otherwise, "... consumers continue wastefully forth, only now they do so with recycled materials instead of virgin ones" (Chapman, 2000, p.170-171). Consequently, a thorough understanding of user behavior is required for design for sustainability, since it confines more sustainable modes of consumption (Fletcher et al., 2001).

### **2.6.1 Design education for sustainability**

Although design education for sustainability is not the main focus of the thesis, the author believes that it is worth to mention briefly about design education for sustainability, since the research analyzes two industrial design projects to explore the post-use design thinking. It is not surprising that education is central to the notion of sustainable development. In other words, education is a key factor to achieve sustainable consumption and production. UNESCO (2005, 2002) emphasized the importance of educating for sustainability through introducing the term education for sustainable development (EDS). The four priorities that EDS stands for are:

- *Improving basic education:* This includes enabling people accessing to basic education, and decreasing the literacy rates all around the world to achieve a sustainable society.
- *Reorienting existing education towards sustainable development:* This includes rethinking and reconsidering the education from nursery school to higher education in a way that principles, skills, and perspectives related to sustainability are included.
- *Public understanding and awareness:* This includes the creation of a public which understands the concepts of sustainability, and is aware of the goal of a sustainable society.
- *Training:* This includes the training of all sectors in the workforce to enable them behaving in more sustainable manners.

The reports of UNESCO focus on the emergence and the importance of education for sustainable development within a broader view of education. Within the field of various

educational programs such as industrial design education, the role of education in terms of sustainable development needs to be explored further. Both industrial design field and education can play a significant role in achieving sustainability. To emphasize the designers' crucial role in achieving sustainable consumption and production Vezzoli (2003) states that "a whole new generation of designers still needs to be educated and employed" (p.2). This statement highlights the importance of the integration of the notion of sustainability into the industrial design education.

Currently there are many industrial design departments (e.g. TU Delft University of Technology, Loughborough University) which aim to integrate the sustainability issues into their design curriculum, either through elective and compulsory courses related to sustainability or integrating sustainability issues into design studio courses. Ramirez (2006) found that design educators (almost all of the respondents in his research) from Australia agreed that sustainability should be an integral part of industrial design curriculum, whereas some disagreed that (i.e. three-quarters of respondents) sustainability issues should be discussed in detail in separate courses (e.g. elective or compulsory). This implies that sustainability issues should be an integral part of the industrial design courses to better address sustainability within industrial design education.

Today, there are many tools developed for the design students, educators and design practitioners in order to integrate sustainability into their area of work. These tools and related networks that provide students, educators, and practitioners with information related to design and sustainability are summarized in Table 2.3.



Table 2.3: Tools for design education for sustainability

**Okala ecological design guide**

Okala ecological design guide provides design practitioners, educators and design students with information about eco-design and sustainable design. The guide covers various issues related to sustainable design such as life cycle strategies, environmental impact assessments and exploration of designers' role in dealing with the environmental crisis (White et al., 2007)

**LENS**

The learning network on sustainability (LENS) is a network for curricula development on design for sustainability focusing on product-service system innovation, and it aims to encourage a new generation of designers (and design educators) who can contribute to the transition towards a sustainable society. The network provides designers with e-learning sources and tools for developing sustainable solutions (LENS, n.d.).

**RAPI.RETE**

This network provides tools to support design educators and students in the educational content and processes related to sustainability issues. The tools that are provided by the network are namely ECO.CATHEDRA, ECO.OFFICINA, ECO.DISCO and DPS.MANUAL (Vezzoli, 2003). These tools can also be accessed through LENS network mentioned above.

**Sustainable Design Network (SDN)**

Sustainable Design Network (SDN) was founded to establish multi-disciplinary research network which combines the industry and the university for addressing the issues of sustainable design including the methods, tools and techniques to aid its integration into practice. The network aims to transfer the knowledge and experience between industry and university including departments of engineering design, industrial design, management (SDN, n.d.).

**Tool box**

Tool box (2004), which is created by Bhamra and Lofthouse in Loughborough University, is a collection of information and methods and tools for sustainable design education. It aims to guide the educators (from engineering and industrial design) who recognize the importance of sustainable design in undergraduate and graduate education.

**Gaia Education**

Gaia education aims to develop curricula for sustainable community design, and it promotes a holistic approach to education for sustainable development. This foundation works in collaboration with universities, government and non-governmental institutions particularly on creating eco villages. Gaia Education arranges various training programs worldwide about eco villages and sustainable development (Gaia Education, n.d.).

## 2.7 Product longevity

In order to better explain product longevity, product obsolescence will be explained in the following section.

### 2.7.1 Product obsolescence

Obsolescence is defined as “the process of becoming obsolete or the condition of being nearly obsolete” (Merriam-webster dictionary, n.d.). When we consider product obsolescence what becomes obsolete here is the product due to several reasons. Packard (1960) defines three types of obsolescence: obsolescence of function, obsolescence of quality and obsolescence of desirability:

- Obsolescence of function: An existing product becomes outmoded when a product is introduced that performs function better.
- Obsolescence of quality: A product breaks down or wears out at a given time, usually not too distant.
- Obsolescence of desirability: A product that is still sound in terms of quality or performance becomes ‘worn out’ in our minds because a styling or other change makes it seem less desirable (p.55).

Obsolescence of function (or functional obsolescence) occurs when a superior product is introduced to the market. For instance, when the color televisions were first introduced to the market, black and white televisions were replaced by them. Obsolescence of quality refers to exhaustion of a product within a short time in terms of its quality. The example of such obsolescence can be found in the motorcar industry where the overall quality of the motorcars decreased (Packard, 1960). The obsolescence of desirability (or psychological and aesthetic obsolescence) tends to occur when a product seems to be undesirable to the users in terms of its aesthetic, functional or symbolic value, leading that users do not want to keep the product any longer even though it still functions properly.

Considering three types of obsolescence, the obsolescence of desirability (or psychological obsolescence) seems to be an area where users’ actions and behaviors can be more influential on the product life spans than the other types of product obsolescence. From an environmental perspective psychological obsolescence is worth exploring, since the analysis of discarding behavior related to psychological obsolescence could contribute to increased product life spans.

### 2.7.2 Increased product life spans

Product longevity has significant importance within the notion of sustainability. Cooper (2005) argues that sustainable consumption and production demands increased product life spans (Figure 2.10).

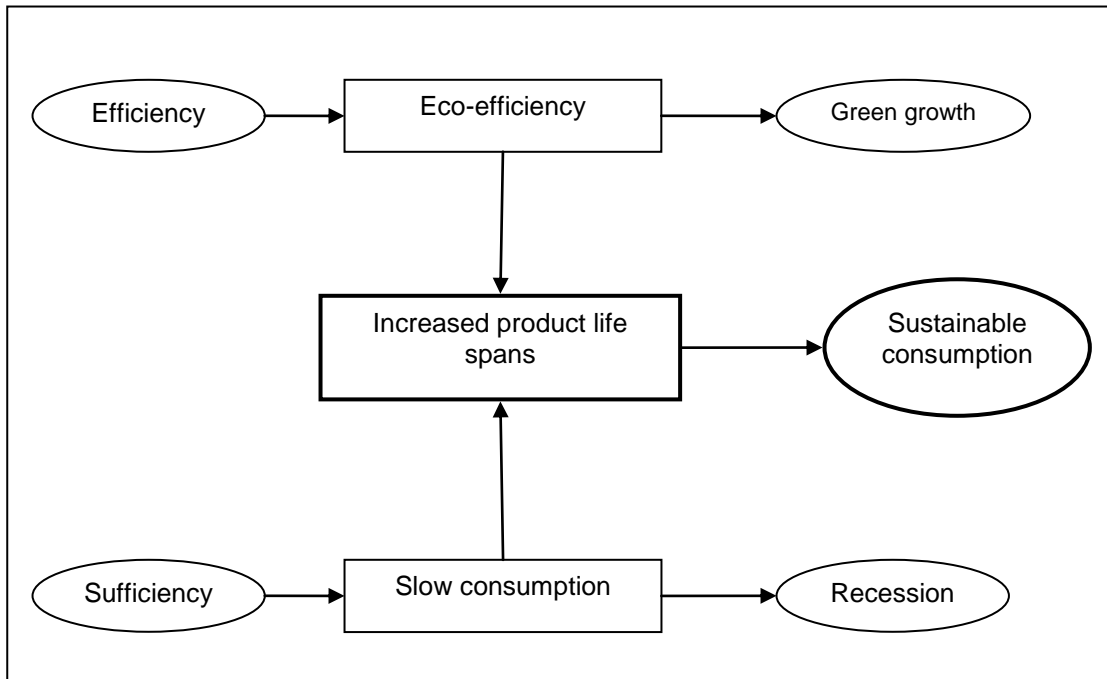


Figure 2.10: Product life spans and sustainable consumption (adapted from Cooper, 2005)

The model proposed above begins with efficiency and sufficiency solutions. It indicates that efficiency and sufficiency solutions do not address sustainable consumption by themselves. This implies that both parties should be considered for achieving sustainable consumption. Cooper (2005) argues that the efficiency solutions such as eco-efficiency lead to 'green growth' which can be offset by increased consumption, whereas the sufficiency solutions such as slow consumption (i.e. reduced throughput of products and services) lead to recession due to reduction in purchase products with short life spans. On the other hand, the combination of resource productivity with slower throughput leads to increased product life spans and towards sustainable consumption (Cooper, 2005). Hence, increased product life spans incorporating both sufficiency and efficiency solutions can significantly affect the notion of sustainable consumption.

### 2.7.3 Strategies for increased product life spans

Product life spans can be extended through product maintenance, repair, reuse, remanufacturing, and reconditioning<sup>6</sup> (Lewis et al., 2001). There is no doubt that such strategies or services can contribute to product longevity. However, user behavior should also be taken into account to ensure a significant improvement in product life spans. Van Nes (2006) categorizes the influencing factors which can cause early replacement of products as follows:

1. Product characteristics: The product characteristics refer to those aspects of the product that provide an added value of one product over another.
2. Situational influences or external influences: Factors extrinsic to the product, meaning working from outside and not a part of the essential nature of the thing.
3. Consumer characteristics: The consumer characteristics refer to those differences between people that explain why, in the same situation, different people make different choices.

(p. 104)

As the categorization indicates consumers play a role in determining the product life spans. In addition to that, Cooper (2004) argues that user behavior has as much influence on product life spans as design specifications of the products. Therefore, the analysis of user behavior is worthwhile for increased product life spans.

Another strategy to increase product life-spans is product attachment (Van Hemel et al., 1997). People tend to handle their products with care, repair them when they are broken, and do not discard them within a short time when they feel attached to them (Schifferstein & Pelgrim 2008). Since product attachment can postpone the product replacements, it can provide valuable opportunities for sustainable consumption and production in terms of product longevity.

Extending the “psychological life spans” of the products through creating a bond between products and users can also be a strategy to achieve product longevity (Verbeek et al., 1998, p.30). Here, the term ‘psychological life span’ refers to the life span of a product which is determined mainly through various reasons related to psychological obsolescence (termed by Packard, 1960). These reasons can include the changes in the product (e.g. fading colors, dirty surfaces etc.), the user (e.g. changes in preferences when become older) and the circumstances (e.g. fashion changes, moving to another social group) (Muis, 2006). When a bond is created between users and their products, they may have a tendency to keep the product as long as possible, in turn, this increases the product life spans.

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<sup>6</sup> Reconditioning is “ rebuilding of major components to a working condition that is generally expected to be inferior to that of the original model” (King et al, 2006, p.261)

In summary the strategies for increased product life spans may include post-use services such as product maintenance, repair, re-use, product care, remanufacturing and recovering, which focuses on mainly production side within the responsibility of the companies. In addition to these, strategies such as product attachment and prolonging psychological life spans focus on mainly consumption aspect influenced by user behavior. It is clear that both strategies have many advantages in terms of product longevity. However, to address sustainable consumption and production, the combination of these strategies focusing on both spheres (consumption and production) of sustainability would be required.

## **2.8 Post-use design thinking**

Besides those attempts to prolong product life spans, this research proposes and terms an approach called 'post-use design thinking' which concerns consumption and production issues in terms of sustainability. Production issues related to this design thinking contain post-use design solutions (including post-use services at local and regional levels). This implies that creating objects through transformation of products into new ones and the use of locally available resources (i.e. materials and production methods) in order to enable this transformation. The consumption issues related to this design thinking include users' involvement in transforming the products into new ones through incorporating various product accessories, and fostering the emotional bond between the users and their products. Hence this approach aims to integrate both the consumption related strategies and product related ones into the design process to achieve product longevity.

The post-use design thinking mainly emphasizes two aspects, which are *design process* and *user involvement*. Firstly, this design thinking requires the incorporation of post-use design solutions into the idea generation phase of the product design process. To enable this design thinking, both use and post-use solutions should be considered concurrently in the early stages of the design process along with product design details, features or specifications. Secondly, this thinking encourages and enables user involvement in the product design and development process, since this can allow users to re-value their products and keep them for a long time

The post-use design thinking might be defined as an approach which endeavors to integrate the potential post-use design solutions into product design and development process. The integration of this design thinking would enable a product to be re-used after the fulfillment of its initial use phase. This also involves the transformation of products into 'new' products or 'new'

contexts by encouraging users to participate in both the process of 'designing' and 'transforming'. For instance, as it is illustrated below, a play mat that a child uses could be transformed into a curtain for its post-use phase through making changes on the previous product. The end product evolves into a record of her/his childhood (Figure 2.11). Consequently, the post-use design thinking would be an effective tool to increase product life spans through suggesting not only 'new' products designed with minimum resources, but also enduring products that users want to keep for a long time. Hence, it would be a promising approach to achieve sustainable consumption and production by reducing the resource flow rates in terms of re-using and re-valuing the materials and energy being used for that particular design.

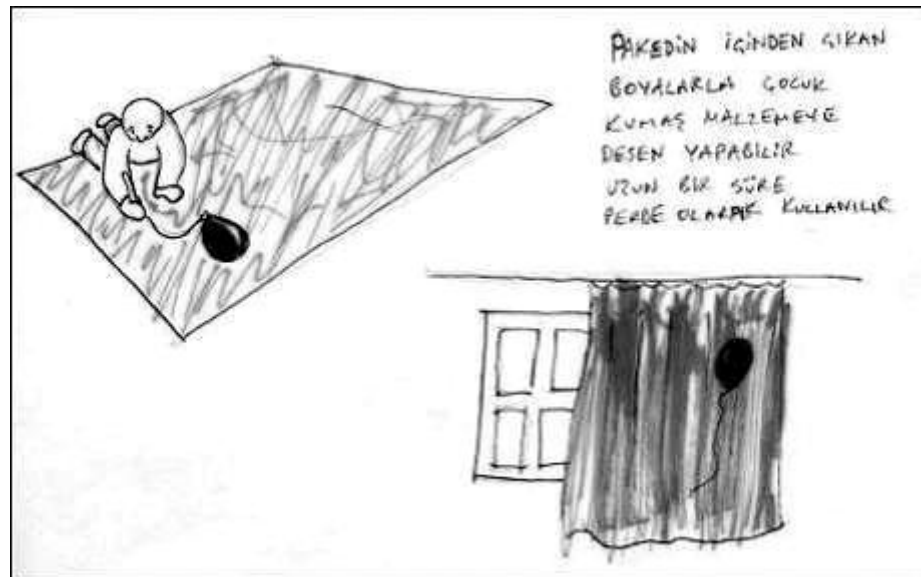


Figure 2.11: An example of the post-use design thinking: a playground-curtain (retrieved from ID 301 Industrial Design III course materials, 2009-2010)

Another example for the post-use design thinking can be "curtain with dressmaker's pattern" that is designed by Djoke de Jong in 1993. This product can be used as a dressmaker pattern after it fulfills its primary use phase as a curtain (Figure 2.12).

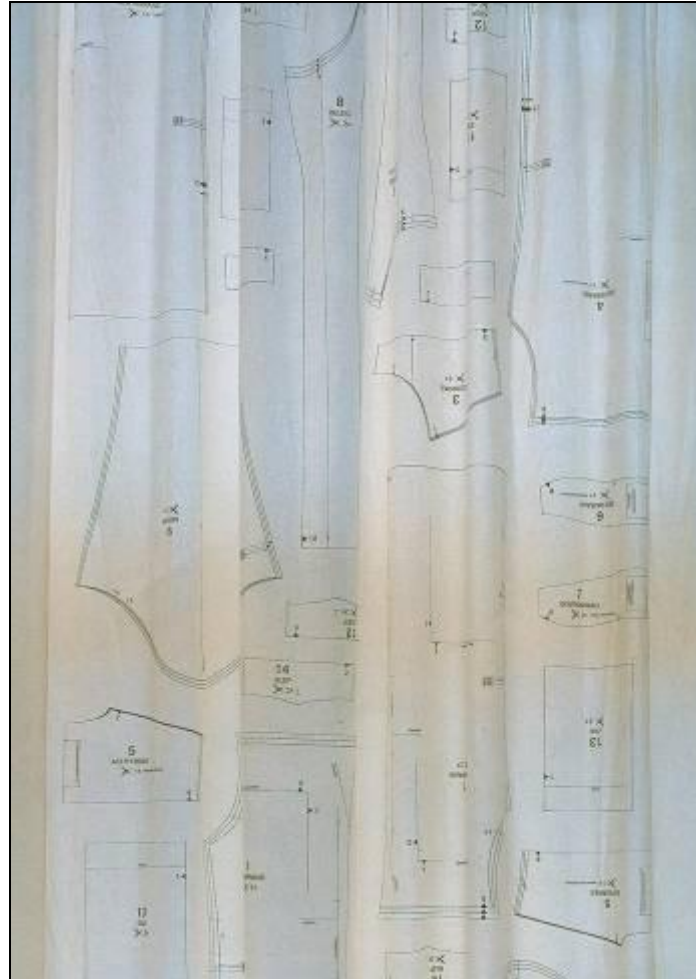


Figure 2.12: Curtain with dressmaker's pattern, Djoke de Jong, 1993 (reproduced from Ramakers et al,1998)

This chapter has mentioned the importance of the environmental issues and approaches for achieving sustainable consumption and production. It is apparent that design has a central and influential role for the notion of sustainable consumption and production. Therefore, the design focused approaches have been presented in detail in this Chapter. In addition to that, the importance of product longevity for addressing environmental and social sustainability, and the strategies for achieving product longevity have been discussed. Finally, an approach namely 'post-use design thinking' has been presented for designing products with increased life spans.

In the following chapter, the data collection and analysis methods used for this research to explore the post-use design thinking will be discussed. More specifically, Chapter 3 will provide detailed information on semi-structured interviews and content analysis.

## CHAPTER 3

### METHODOLOGY

This chapter begins with the explanation of research stages and continues with data collection and analysis tools used throughout the research. In particular, semi-structured interviews and content analysis will be explained. The chapter concludes with detailed information about preliminary study and primary research, including interview questions, population and sampling, and data analysis procedure.

#### 3.1 Research stages

The post-use design thinking is a relatively new approach in terms of design practice and design education. In other words there are a few products (e.g. curtain with dressmakers' pattern, designed by Djoke de Jaong, see section 2.8) which may be potentially designed through this design thinking. The term can also be regarded as a new concept for the companies related to the industrial design practice. Therefore, to explore this approach further two educational industrial design projects carried out in the Department of Industrial Design at METU in 2009-2010 were analyzed. The first project (referred as Project 1 from now on) aims to develop sustainable solutions for kids (between age of 3 and 6) to create a space of their own, and the second project (referred to as Project 2 from now on) is transcending products - sustainable alternatives for glass packaging with a special emphasis on the post-use phase of the products. Project 2 is carried out in collaboration with Anadolu Cam Sanayii A.S., a major glass packaging manufacturer in Turkey.

The research consists of mainly three parts: literature review, preliminary study and primary research (Figure 3.1). The preliminary study focuses on the Project 1, and it includes the analysis of the outcomes of the Project 1, and the semi-structured interviews conducted with the industrial design students. The primary research focuses on the Project 2, and it includes the analysis of the project outcomes, and the semi-structured interviews with ID students and representatives from the manufacturer firm (i.e. a chief mould design manager and an industrial designer).



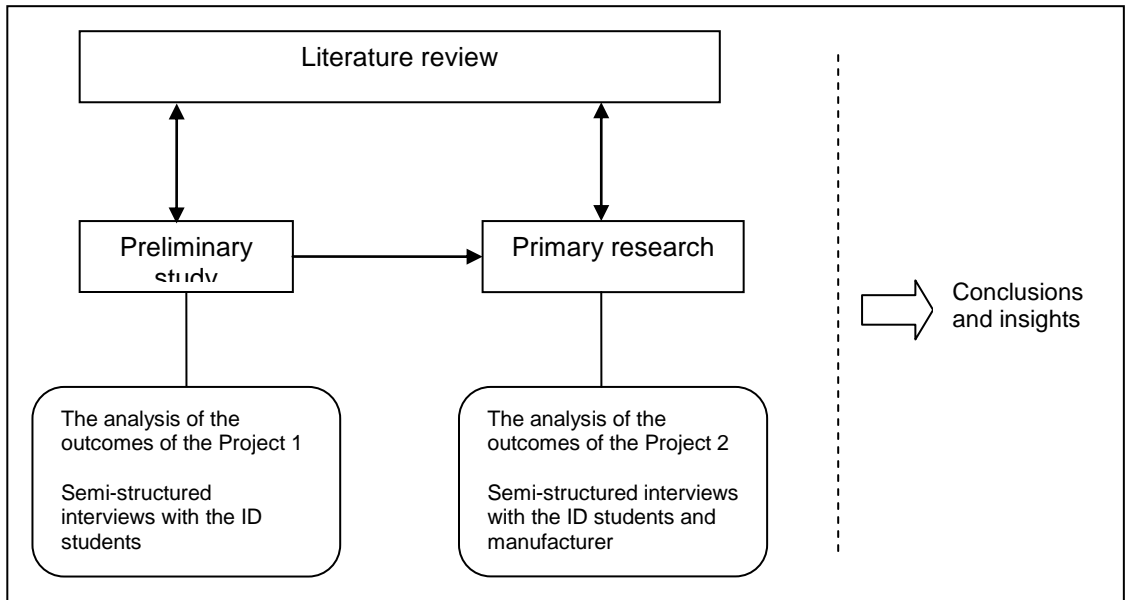


Figure 3.1: Research stages

## 3.2 Data collection method

Throughout the study, the semi-structured interviews were conducted to gather detailed information, and content analysis was applied to analyze the data gathered from the interviews.

### 3.2.1 Semi-structured interviews

Semi-structured interviews are widely used for data collection in qualitative research. This type of interviews has predetermined questions which the wording and the order of the questions can be changed (Robson, 2002). The conversation is moderated partly by the respondent and partly by the researcher. Semi-structured interviews are in the middle of (i.e. in between) structured interviews including predetermined questions with fixed wording, and unstructured interviews allowing the respondent to talk freely without any predetermined questions. This position between rigid structure and complete uncertainty can “provide the researcher with in-depth information on the topic of interest without predetermining the results” (Cook, 2008). Semi-structured interviews were chosen as a data collection tool for this study due to their ability to provide in depth information to the researcher on a specific topic.

The respondents for the semi-structured interviews related to preliminary study were only the third year ID students, while the respondents of interviews related to primary research were the

ID students and representatives from Anadolu Cam Sanayii A.Ş. All of the interviews were audio taped in order to prevent data loss. The interviews conducted with the students were accompanied by the visual materials (e.g. sketches, renderings, presentation boards and 3D models) which they presented and submitted during the projects.

### **3.3 Data analysis method**

#### **3.3.1 Content analysis**

Content analysis is a method for analyzing both qualitative and quantitative data, and it is a commonly used method in analyzing qualitative and quantitative data to make inferences from the text. Julien (2008) defines content analysis as “the intellectual process of categorizing qualitative textual data into clusters of similar entities, or conceptual categories, to identify consistent patterns and relationships between variables or themes”. For content analysis, the data can be gathered through various mediums including textual (e.g. interview transcripts, newspapers), audio (e.g. speeches) and visual data (e.g. drawings, photographs, video recordings). In order to classify the data and transform it into a meaningful form, codes and categories can be used in the content analysis. The codes and categories can be generated based on some existing theories or concepts (deductive), or from the raw information gathered through research (inductive). Quantitative content analysis is a deductive process, which produces frequencies of predetermined categories prior to research or values associated with particular variables, whereas qualitative content analysis is inductive, it includes detailed reading of the text and revealing the unclear contextual content (Julien, 2008). For this research inductive approach is used to define codes and categories, since it is structured as a qualitative research (see Section 3.5.3). The reason for the use of content analysis method in this study is that it can provide the researcher with opportunities to analyze a specific issue in detail through making inferences from the data.

#### **3.4 Preliminary study**

The preliminary study was conducted prior to Project 2 and also primary research, in order to provide feedback for structuring Project 2 and primary research, in particular for interview questions. For this study, the outcomes of the Project 1 were analyzed, and the semi-structured interviews were conducted with the students. The semi-structured interviews include questions related to the design process (integration of the post-use design thinking), difficulties that the students encountered during the project, reflection of the post-use aspect in the final product,

and one of the tasks from the task exercise (i.e. a specific task<sup>7</sup> developed through considering the post-use phase).

#### **3.4.1 Semi-structured interview questions**

Prior to the interviews, a series of pilot interviews conducted for the preliminary study in order to control the validity of interview questions. Afterwards, a few questions were revised and rephrased, or omitted. The revised versions of interview questions for the preliminary study are given in Table 3.1. It should be noted that due to the structure of the interviews, additional questions emerged depending on the context and the flow of the interview. These additional questions were excluded. Therefore, the questions below are the ones prepared by the researcher prior to the interviews. Furthermore, the interview questions were prepared in Turkish, the original questions can be found in Appendix A.

Table 3.1: Semi structured interview questions for preliminary study

1. Considering your design process, at which stage did you begin to consider/think 'post-use'?
2. Considering your design process, how did you reflect the post-use aspect in your final product idea? Could you explain this process through product examples? \*
3. Have you ever encountered any difficulties or critical issues, considering the post-use aspect? If yes, could you explain this process through product examples?
4. What are the implications of the task exercise for considering the post-use aspect for your final product idea? \*

\*Revised version of questions

#### **3.4.2 Population and sampling**

The interviews were conducted with the third year industrial design students due to their attendance in the Project 1, carried out in the Department of Industrial Design at METU. The analysis of the results from the task exercise along with the project outcomes contributed to the sampling of the group of students (among whole class) encountering difficulties in integrating

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<sup>7</sup> The specific task for the exercise was 'turn the product into record of one's childhood'.

the post-use design thinking into the design and development process. In other words, through analyzing the outcomes of the task exercise, the students were divided into various groups with which semi-structured interviews were conducted. The groups were selected by considering two questions:

- to what extent a student fulfills the specific post-use task as a requirement of the task exercise
- to what extent a student reflects the post-use aspect in the final product idea.

Consequently, the whole class divided into four groups (Table 3.2).

Table 3.2: Groups for the semi-structured interviews

	Task exercise		Final product idea		Students	interviewees
	Fulfilled the specific post-use task *	Did Not fulfill the specific post-use task	Reflected the post-use aspect	Not reflected the post-use aspect		
Group 1	x		x		2	-
Group 2	x			x	10	3
Group 3		X	x		8	2
Group 4		X		x	8	5

\*The specific post-use task is: "turn the product into a record of one's childhood"

Among the groups, Group 4 was chosen as the most critical group for the semi-structured interviews because the students from that group neither fulfilled the requirement of the specific post-use task, nor reflected the post-use aspect in the final product idea. The interviews with the students in this group would better address the difficulties encountered during the idea generation phase, which in turn would inform and improve the design process further. Therefore, the majority of the interviewees ( $n: 5$ ) were chosen from the Group 4. The rest of the interviewees were chosen from Group 2 ( $n: 3$ ) and Group 3 ( $n: 2$ ). Furthermore, the students from Group 1 was excluded from the interviews, since the students in this group fulfilled the requirements of the task exercise and they reflected the post-use aspect in the final product

idea. The main purpose of the preliminary study was to have a better and an overall understanding of the challenges that the students had during the design process regarding the post-use thinking, rather than attempting to define the main differences among the groups.

### **3.5 Primary research**

The research questions mainly focus on the design process including idea generation phase, and the implications of post-use design thinking for the design process, and the potential post-use solutions developed by the ID students. Since the research consists of two industrial design projects, further insights from professional designer and design manager related to production and design appear to be invaluable for evaluating the post-use design thinking in terms of feasibility or applicability.

In order to provide insights into the first four questions, the outcomes of the Project 2 were analyzed, and the semi-structured interviews were conducted with the ID students. For the last question (i.e. is post-use scenario thinking possible/feasible for designers, is it possible/feasible for manufacturers?), the semi-structured interviews were conducted with the chief mould design manager and an industrial designer from the manufacturer (Anadolu Cam Sanayii A.Ş.).

Throughout the study, the semi-structured interviews were used for data collection. For the primary research, two of the students could not attend the interviews; therefore the use and post-use solutions that these students developed were excluded from the study. The interviews with the ID students were conducted along with the help and use of the visual materials such as sketches, renders, 3D models which the students developed during the projects. The visual materials helped the students to recall what they did and what they considered when developing the initial ideas, and this also enabled the researcher to gain thorough insights into the idea generation phases, and use and post-use solutions. The analysis of the project outcomes were made through using the information gained from interviews. This helped the researcher to determine and classify the use and post-use solutions including design considerations and product scenarios.

#### **3.5.1 Semi- structured interview questions**

The interview questions for the ID students focus on various issues such as the research conducted prior to idea generation, idea generation exercises (matrix exercise, task exercise and scenario building exercise) performed during the project, and the features of the final

product ideas (design considerations, use and post-use solutions etc.). Prior to the interviews, pilot interviews were conducted to control the validity of the questions. After the pilot interviews, a question related to the interaction between use and post-use phases was added and the order of the question related to literature search and field observations was changed. The interview questions for ID students are presented in the Table 3.3. The questions were prepared in Turkish, the original versions of questions can be found in Appendix C.

Table 3.3: Semi-structured interview questions for ID students

<p><b>Research</b></p> <ol style="list-style-type: none"> <li>1. How did the literature search and field observation (conducted prior to the idea generation) influence your project? *</li> </ol> <p><b>Idea generation phase</b></p> <ol style="list-style-type: none"> <li>2. How did the matrix exercise affect your idea generation process?</li> <li>3. Could you explain the idea generation process where you develop ideas for use and post-use concurrently?</li> <li>4. How did the specific themes for the matrix exercise (e.g. super lid, my sweet glass hugger and my natural make up) influence your idea generation process?</li> <li>5. Could you explain what kind of aspects you considered for choosing use and post-use phases of the products offered by the project (e.g. jars - candle jars)?</li> <li>6. How did the predetermined post-use product categories (i.e. water bottles and candle jars) influence your idea generation process?</li> <li>7. How did the task exercise influence your idea generation process?</li> <li>8. How did the scenario building exercise influence your idea generation process regarding the post-use phase?</li> </ol> <p><b>Final product idea</b></p> <ol style="list-style-type: none"> <li>9. Considering the final product idea, how did use and post-use phases of the product influence each other?*</li> <li>10. Considering the final product idea, which one of the product phases (use and post-use) was emphasized more?</li> <li>11. What kind of scenarios did you offer for the use and post-use phases? What were the reasons for offering such scenarios?</li> <li>12. Could you explain what kind of alterations did you offer for transforming the products into their post-use phases? How would these alternations be made? What were the reasons for offering such alterations?</li> <li>13. Did you consider designing a product whether either referring to its use phase or not? If yes, what kind of solution did you offer to do so? If no, what kind of solutions to remove the reference to use phase?</li> <li>14. Did you consider post-use solutions related to personalization during the idea generation?</li> </ol>
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\* After pilot interviews, the order of this question was changed.

\*\* This question was added after the pilot interviews.

### 3.5.2 Population and sampling

The interviews were conducted with the third year ID students based on their attendance to the Project 2. The number of the students attending the Project 2 was twenty three. However, the researcher was able to conduct interviews with 21 students. Two students were excluded because of their unavailability within the interview schedule.

### 3.5.3 Data analysis process

As stated before, for analyzing the data, the method of content analysis was used. In order to define categories and codes for analyzing the data, inductive approach was employed. Categories were determined in accordance with the interview questions, the design process and the insights from the interviews. More specifically, the categories for the primary research are summarized in Table 3.4.

Table 3.4: Categories for the analysis of the primary research

Categories	Sub-categories	Category description
Research	<ul style="list-style-type: none"><li>▪ Field observation</li><li>▪ Literature search</li></ul>	Field observations and literature search conducted by the students
Idea generation phases	<ul style="list-style-type: none"><li>▪ Matrix exercise</li><li>▪ Task exercise</li><li>▪ Scenario building exercise</li></ul>	The idea generation exercises that the students performed during the projects.
Final product idea	<ul style="list-style-type: none"><li>▪ Design considerations</li><li>▪ Proposed scenarios</li><li>▪ Alterations during transformation</li><li>▪ Product accessories</li></ul>	This category includes the design considerations that the students took into account during the project, the scenarios and the accessories offered for the use and the post-use phases, and the alterations required/proposed during transformation into the post-use phase.

Depending on the categories and codes determined, the interview results and project outcomes of each student were analyzed case by case. Tables that include conclusions and insights were prepared for each student (see Chapter 5). Afterwards, through grouping the findings and insights from the interviews associated with interview questions and categories, overall conclusions were made (see Chapter 5).

#### **3.5.4 Limitations of the study**

The researcher has worked as a teaching assistant in the Department of Industrial Design in the third year design studio, he was also involved in the projects (analyzed throughout the study) as an evaluator of the design process and the project outcomes. This involvement has provided the researcher with required knowledge about the idea generation process of the students and the design solutions that they developed during the project. In particular, the researcher has benefited from this knowledge while analyzing the project outcomes and also interviewing the students (i.e. asking specific questions about a specific design solution). On the other hand, this involvement could also affect the students' (i.e. respondents') attitude towards the researcher, implying that it could hinder receiving the right information from the students related to a specific question. In other words, students' might have a tendency to give biased answers to the interview questions, assuming that they would be evaluated for their responses.

All of the interviews in the research were conducted in Turkish. The reason for this is the notion that when they speak in their mother language, informants have a tendency to talk freely and give detailed information about a specific topic, which is significant for the qualitative research. In order to present the results, the interviews were translated into English by the researcher. Therefore, the results might depend on the inferences which researcher made during the translation process, and also the analysis of the interviews.

The content analysis is preferred as data analysis method for the study. In the content analysis the results depend on the ability of the researcher to make inferences from the text, based on a more inter-subjective approach. Therefore, the interviews (i.e. transcripts) were analyzed and coded word by word by the researcher and controlled by the thesis supervisor.

This chapter has provided information about the research stages, and the methods for and the means of data collection and analysis. It has presented the structure of the preliminary study and the primary research. Specifically, the semi-structured interview questions along with the population and sampling, and the specific categories for analyzing the interview data have been revealed. In the following chapter, the results of the preliminary study will be explained in detail.



## CHAPTER 4

### PRELIMINARY STUDY

This chapter will explain the Project 1 in detail, including the definition and aim of Project 1; the phases of Project 1, and the task exercise, a special exercise for idea generation given by the course tutors (see Appendix E). This chapter will also present the results and conclusions from the preliminary study. This study includes the analysis of the task exercise for Project 1 along with the conclusions from the semi-structured interviews conducted with the ID students regarding the implications of the post-use and the task exercise given for the Project 1 (a brief description of this exercise is presented in Section 4.2.3).

#### 4.1 Project 1

##### 4.1.1 Definition of the Project 1

The aim of the Project 1 is to develop sustainable solutions for kids (between age of 3 to 6) to create a space of their own. The solutions incorporate embodying kids' privacy and space needs, fostering creativity, participation and interaction, and promoting affordable and accessible alternatives to mainstream solutions (for project brief see Appendix D).

##### 4.1.2 Phases of the Project 1

Project 1 consists of four parts: design research, idea generation, product development and final design. Firstly, the students conducted design research including literature review on research topics given, and user observation. Secondly, brainstorming sessions, mood boards, and matrix and task exercise<sup>8</sup> were carried out for the idea generation phase. Based on the findings from the design research phase, the students provided four project dimensions critical for the project. Afterwards, mood boards (visual representations of each dimension) were prepared for inspiring design ideas. Through using the project dimensions (e.g. transformable, interactive, affordable etc.) and specific themes given by the tutors, the students performed the

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<sup>8</sup> The Matrix and Task exercises were initially developed at METU Department of Industrial Design by Gulay Hasdogan, Fatma Korkut and Gun Acar, and evolved into a shared tool used by the faculty over the last seven years.

matrix exercises to generate various ideas. At the end of the idea generation phase, the task exercise was given to the students including a specific post-use task. After the idea generation phase, the students developed products or concepts further along with user participation and testing. Lastly, the design solutions were finalized and presented to the course instructors and other faculty members.

#### **4.1.3 Task exercise**

As for the task exercise carried out during the project, one of the aims of this exercise was to help the ID students consider the post-use design thinking during the Project 1. The task exercise was conducted as a team work to develop and enrich the initial ideas based on the four tasks given to the students during idea generation phase (see Appendix E). Each team member contributed to developing ideas by performing the four tasks in turns. One of the four tasks was directly linked to the post-use design thinking that was “Turn the product or one of its components into a record of one’s childhood.” The preliminary study includes the analysis of the outcomes of this specific post-use task.

For this study, particularly the outcomes of the task exercise carried out in the idea generation phase were analyzed along with the project outcomes in terms of the post-use aspect. Furthermore, followed by this analysis, the semi-structured interviews were conducted with the third year ID students to gather insights into the task exercise and the design process. Consequently, the analysis of the task exercise together with interviews has provided beneficial insights for evaluating the integration of the post-use design thinking into the design process.

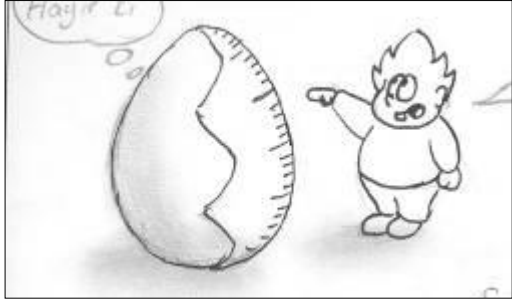
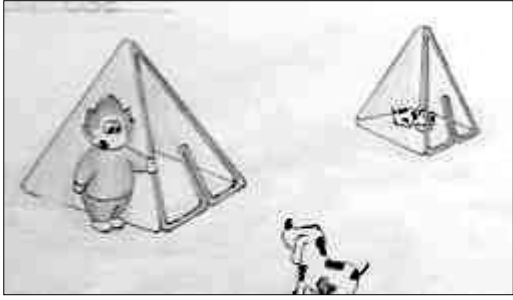
## **4.2 Results of the preliminary study**

The question that preliminary study sought to answer was *what would be the implications of the integration of the ‘post-use design thinking’ into the early stages of design process (i.e. idea generation phase)?* The results of the preliminary study are summarized in Table 4.1, Table 4.2 and Table 4.3 (the groups were determined before the interviews, for additional information about the selection of these groups see Chapter 3).

### **Group 1**

The students in this group consider the post-use phase after finalizing the product concepts, so they are not able to reflect the post-use aspect (see Figure 4.2), even though they fulfill the main requirements for the task exercise (see Figure 4.1).

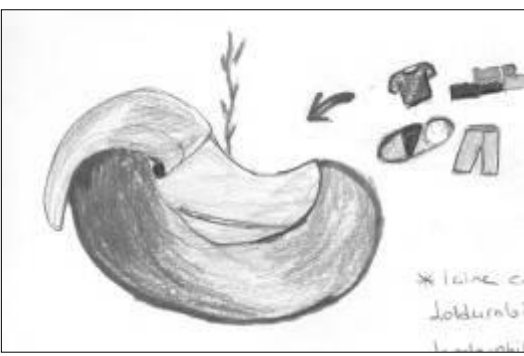
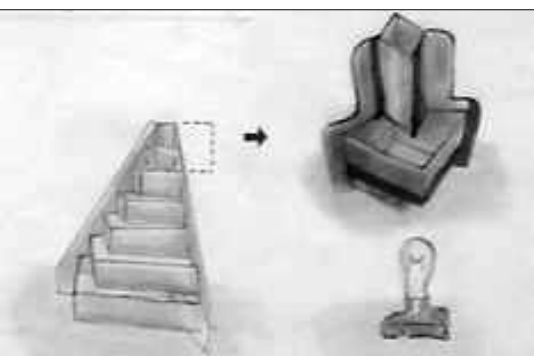
Table 4.1: Product examples for group 1

Task exercise	Final product idea
 <p data-bbox="451 730 716 758">Figure 4.1: A toy for kids</p> <p data-bbox="321 785 846 867"><u>Use phase:</u> A toy for kids <u>Post-use phase:</u> A storage unit and object as well as measuring height of the kids</p>	 <p data-bbox="964 730 1317 758">Figure 4.2: A playing tent for kids</p> <p data-bbox="873 785 1235 842"><u>Use phase:</u> A playing tent for kids <u>Post-use phase:</u> A dog house</p> <ul data-bbox="922 869 1382 951" style="list-style-type: none"> <li>▪ Since there is no change in the design solution, it is an example of alternative use, not post-use.</li> </ul>

## Group 2

The students in this group consider the post-use phase during the idea generation phase. They are able to reflect the post-use aspect in the final product (see Figure 4.4), even though they don't fulfill the main requirements for the task exercise (see Figure 4.3).

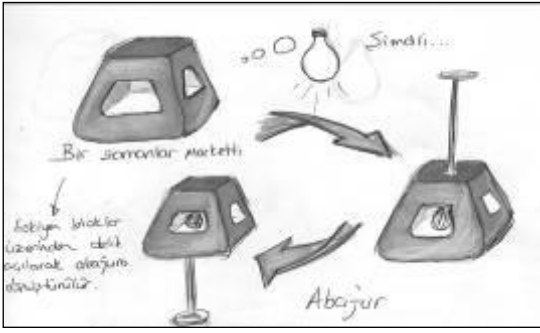
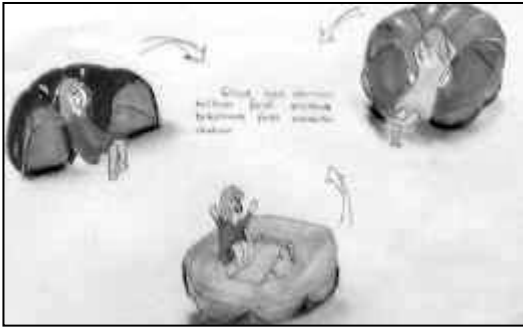
Table 4.2: Product examples for group 2

Task exercise	Final product idea
 <p data-bbox="451 1751 716 1778">Figure 4.3: A toy for kids</p> <p data-bbox="321 1806 732 1862"><u>Use phase:</u> A toy for kids <u>Post-use phase:</u> A storage unit for kids</p>	 <p data-bbox="915 1751 1349 1778">Figure 4.4: A playing environment for kids</p> <p data-bbox="873 1806 1365 1862"><u>Use phase:</u> A playing environment for children <u>Post use phase:</u> Lighting unit</p>

### Group 3

The students in this group don't reflect the post-use phase in the final product (see Figure 4.6) and they don't also fulfill the main requirements for the task exercise (see Figure 4.5).

Table 4.3: Product examples for group 3

Task exercise	Final product idea
 <p data-bbox="410 915 764 945">Figure 4.5: A play ground for kids</p> <p data-bbox="316 970 670 1026"><u>Use phase:</u> A playground for kids <u>Post-use phase:</u> Lighting unit</p>	 <p data-bbox="972 915 1323 945">Figure 4.6: A playground for kids</p> <p data-bbox="885 970 1239 1026"><u>Use phase:</u> A playground for kids <u>Post-use phase:</u> Kids furniture</p> <ul data-bbox="933 1052 1404 1134" style="list-style-type: none"> <li>▪ Since there is no change in the product, it is an example of alternative use, not post-use.</li> </ul>

### 4.3 Conclusions and insights for preliminary study

The study reveals that the task exercise carried out in the idea generation phase appears to be useful for the integration of the post-use design thinking into the design process, and also for understanding and exploring of a new concept or term. Furthermore, for a product designed with the post-use design thinking, it would be more likely that the post-use solutions for that product to be considered at the early stages of the design process. Otherwise, as the results support that, it would be difficult to make changes on a product regarding the post-use aspects after finalizing and detailing the design solution.

From designer's viewpoint, the results also suggest that the post-use design thinking requires much more effort. This process requires designing and developing two product solutions concurrently for the product use and post-use phases, which may lead to some difficulties and challenges during the design process. For instance, the students have some difficulties in generating ideas for the post-use aspect throughout the design process. As a suggestion, idea

pools prepared through field study, including user observations and recordings which investigate user behavior regarding product re-use scenarios at domestic environments, may help students generate diverse and inspirational ideas.

This chapter has presented the findings from the preliminary study; in the following chapter the results of the primary research will be revealed.

## CHAPTER 5

### PRIMARY RESEARCH

This chapter begins with the explanation of Project 2 and then continues with results of the primary research. Results will be presented in two parts. The first part presents the analyses of the project outcomes and the second part presents the case by case conclusions from the semi-structured interviews with the ID students, and the interview results for the manufacturer (Anadolu Cam Sanayii A.Ş.). The chapter concludes with overall conclusions for the primary research.

#### 5.1 Project 2

Glass packaging products are everywhere around us. Glass as a natural material can be recycled and reused, and it is a valuable material in terms of sustainable consumption and production. Considering the recycling process of the glass packaging products, it is critical that consumer products (e.g. glass bottles) should be recovered and reused after they fulfill their initial tasks. According to the report of The Ministry of Environment and Forestry of Turkey (2010), only 25 percent of the total glass packaging waste was re-cycled in 2007. This implies that although glass can be recycled, the recycling rate of the glass waste is relatively low in Turkey. The interview conducted with the glass packaging producer during the research, reveals one possible reason for this situation. In Turkey, recycling and re-using the glass packaging products seems to be inadequate due to insufficient infrastructures for recycling and re-using the glass such as limited number of bottle banks and collection centers, and governmental institutions (e.g. municipalities) have given little attention to the recycling of glass packaging products. Hence, re-using and re-valuing the glass packaging products can make valuable contributions to recovering of glass waste.

To investigate the implications of the post-use design thinking for glass packaging products, the Project 2 was analyzed throughout the primary research. Project 2 was carried out in collaboration with Anadolu Cam Sanayii A.Ş (a major glass packaging producer in Turkey), and

METU Department of Industrial Design. In the following sections the project brief and the phases of the project will be presented.

### **5.1.1 Definition of the Project 2**

The subject of the project 2 was transcending products - sustainable alternatives for glass packaging with a special emphasis on the post-use phase of the products (see Appendix F). The aim of this project was to develop design solutions and relationships, which demonstrated the potential of post-use (i.e. rethink, reuse and recycle/up-cycle for product design) in the area of glass packaging for food and beverages. The project focused on both the use and the post-use phases of the product life span. The emphasis was on transforming mass-produced glass packaging designs (mainly jar and bottle designs) into promotional products (i.e. water bottles and candle jars) incorporating locally produced materials, parts or finishes. After the fulfillment of their initial lifespan, the glass packaging products – mainly jars and bottles – would be recontextualized and transformed into the promotional products..

### **5.1.2 Phases of the Project 2**

The project consists of four parts; design research, idea generation, product development and final design which are similar to the phases of the Project 1 (for the project calendar see Appendix G). During the idea generation phase of the Project 2, the students went through various idea generation exercises: matrix exercise, task exercise, and scenario building exercise. During these exercises students worked individually and they developed design solutions for use and post-use phases of the glass packaging products including water bottles and candle jars, which were predetermined by the course tutors prior to the idea generation phase. The idea generation exercises will be explained in detail in the following sections. For more detailed information about the idea generation exercises see Appendix H.

### **5.1.3 Matrix exercise**

After conducting the literature search and field observation, the students were asked to develop project dimensions for the matrix exercise. This exercise include a matrix consists of three specific themes developed by the course instructors, and the combination of dimensions given by the tutors and added by the students. Through this exercise, the initial and the most significant part of the idea generation phase, the students were asked to develop ideas for use and post-use concurrently based on the themes (Table 5.1) and the dimensions given for the

project such as transformable, tactile, and locally inspired. The students developed initial ideas for use and post-use phases throughout the matrix exercise (Figure 5.1).

Table 5.1: Specific themes associated with project dimensions

Matrix		Dimensions		
		Alternative Dimension I	Alternative Dimension II	Alternative Dimension III
		Transformable	Tactile	Locally-inspired
Themes	Super lid (Lids)			
	Super natural makeup (Surface finishing applications)		x	
	My sweet glass hugger (Product accessories)			



Figure 5.1: An example for the outcomes of matrix exercise (the specific theme is “super natural make-up” and the dimension is “tactile”)

#### 5.1.4 Task exercise

The task exercise was carried out right after the matrix exercise. During this exercise the students chose two ideas from the ones developed during the matrix exercise and then they



applied at least three tasks given for the exercise to each idea chosen (see Appendix I). An example of task exercise is illustrated in Figure 5.2. The specific task for this illustration is ‘a set of products with various sizes and surface finishing applications.

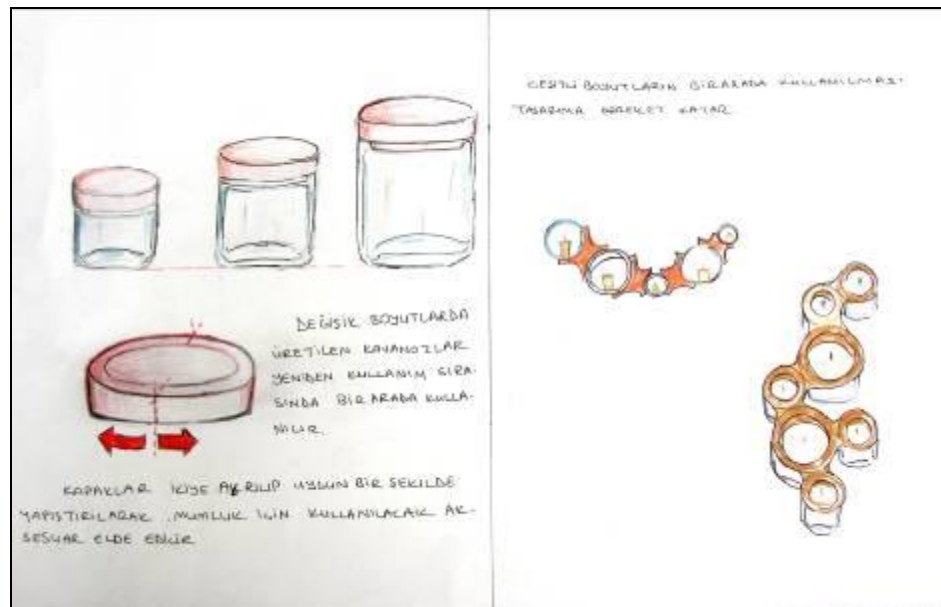


Figure 5.2: An example of the outcomes of the task exercise (the specific task is “set of products with various sizes and surface finishing applications”)

### 5.1.5 Scenario building exercise

The final exercise of the idea generation phase is scenario building exercise. In this exercise, the students developed detailed scenarios for the design solutions or ideas that they developed in the matrix and task exercises. The scenarios were required to describe the glass packaging and its transformation into a promotional product (see Appendix H). The following figure is an example for the proposed scenarios during this exercise.

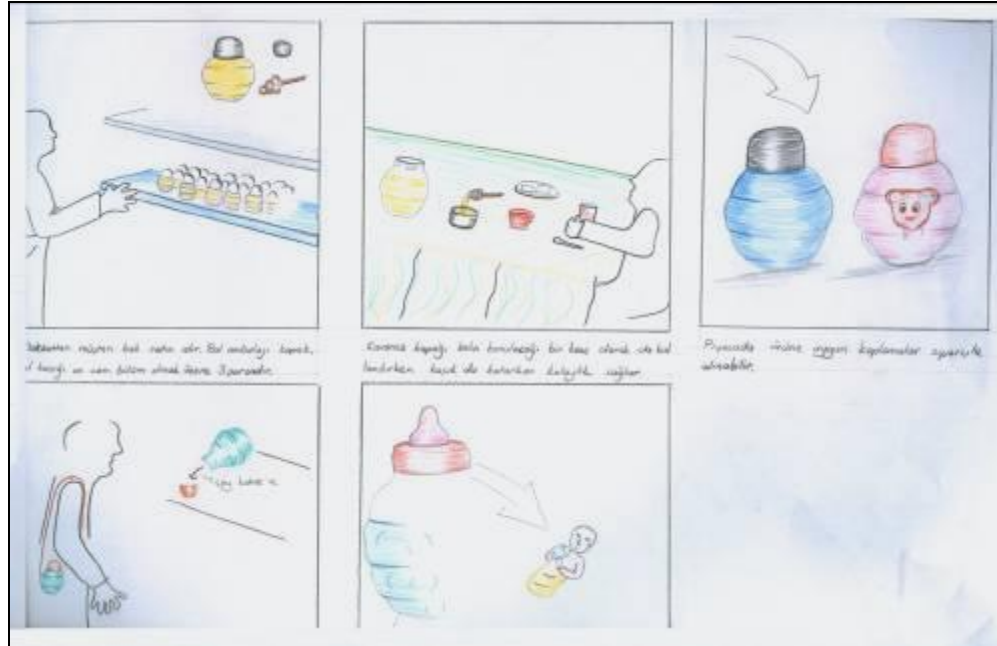


Figure 5.3: An example for the outcomes of scenario building exercise

## 5.2 Outcomes of Project 2

- In total there are 23 students and 23 diverse design projects.
- 13 of these design projects, the glass packaging alternatives are transformed into water bottles for the post-use phase, except one concept is turned into a baby feeder for the post-use phase.
- 10 of these design projects, the glass packaging alternatives are transformed into candle jars for the post-use phase.

### 5.2.1 Product modifications

For the product modifications offered for transforming the glass bottles and jars into water bottles and candle jars, there are mainly three options: lids, surface finishing applications and product accessories. In the matrix exercise, these options are associated with the specific themes which aim to help generate ideas for the post-use phase (see Table 5.1).

#### *Lids*

Considering these three options, the lid is the most favorable option for the post-use phase. It is explored by almost all of the students during the project.

### *Surface applications*

The surface applications can be grouped into three which are changing the form or shape of the glass, incorporating gravures on the glass packaging, and applying 2D prints (e.g. stickers, serigraphic prints etc.).

### *Product accessories*

The product accessories mainly vary according to the type of the materials used for the accessory alternatives. Preferred materials for accessories are mostly fabric along with other materials (e.g. metal, cotton, flock coating)

When the end results of the project were examined, it was seen that the students developed their projects around three main scenarios: selling the product accessory along with the product, selling the accessory separately from the product, and bringing the product to a little scale workshop in order to make modifications in the product (e.g. surface finishing such as coating application).

## **5.2.2 Conclusions for water bottles**

Following the conclusions for water bottles related to product modifications, the outcomes of the Project 2 are presented in Table 5.2.

### **Lids**

One of the design considerations is that the lids of the products should resist being thrown away or lost when the product is used as water bottle. To prevent lids being lost or thrown away, the lid alternatives can be designed in accordance with the cover of the product. In other words, attaching the lids to the covers or sleeves can prevent the lids being thrown away or lost. This seems to be a common design consideration and solution for some projects (6 out of 13).

Several products (4 out of 13) have lids providing additional functions for the post-use phase. For instance, a lid of a water bottle has a specific design detail serving as a personalized area to be marked or signed by the user, which can be very helpful to identify the product in public places or facilities (e.g. sports centers). Furthermore, the lids are used as a cup to drink water, and as a baby feeder spout. The other examples of additional functions are that the lids allow two types of beverage or food to be poured at the same time, and the lids may be used for adding some aromas into the beverage. Consequently, it appears that the lid has provided

students with great opportunities for developing ideas for the post-use within this particular case - glass packaging products.

### **Gravures**

It can be stated that the relationship between covers and gravures on glass might be similar to the relationship between lids and covers. That is to say likewise lids can be attached to the covers/sleeves to prevent being thrown away or lost; the covers/sleeves can be designed in accordance with the gravures on the glass. For instance, referring to the gravures on the glass, some patterns (e.g. logos of glass packaging) as cut outs on covers may help users grab easily the glass bottle, may prevent slipping off the cover, and also reveal some transparent parts to give users feedback.

### **2D print applications**

2D print applications (e.g. stickers, serigraphic prints) appear to be very plausible for the post-use when designer has little opportunity to modify the product. In other words, when the product has certain specifications such as standard lid and labeling, it would be better to modify or add some 2D applications on the product for the post-use phase. For instance, the baby food container (one of the projects) has many certain specifications and design standards. Therefore, the student focuses on designing serigraphic prints to make it more appealing to a specific user group (e.g. animated characters for children), which does not intervene with the specifications for the baby food container and the baby feeder.

### **Product accessories**

Considering the product accessories (especially covers or sleeves) developed by the students, it seems that covers and sleeves do not cover all surfaces of the glass packaging, since users may need to see how much water is left inside the bottle. Therefore, the cover alternatives should be designed through considering transparency in order to give feedback to the users. The covers/sleeves can be used to prevent water bottles being broken. Furthermore, they can contribute to preservation of the beverage temperature (i.e. thermal insulation).

Table 5.2: Design solutions for use and post-use (water bottles)

Final product idea		Product modifications					
		Lid	Form	Surface applications Gravures	2D print	Covers/sleeves	Product accessories Others
							
							
							
							

Table 5.2 (continued)

Final product idea		Product modifications					
		Lid	Surface applications			Product accessories	
Use	Post-use		Form	Gravures	2D print	Covers/sleeves	Others
							
							
							
							

Table 5.2 (continued)

Final product idea		Product modifications					
Use	Post-use	Lid	Surface applications			Product accessories	
			Form	Gravures	2D print	Covers/sleeves	Others
							 Cotton rope
							
							
							
							

### **5.2.3 Conclusions for candle jars**

Following the conclusions for candle jars related to product modifications, the outcomes of the Project 2 are presented in Table 5.3.

#### **Lids**

The lids provide additional space for the labeling. For the post-use, placing the label on the lid can make the products desirable for users, since they may not want to use jars labels of which are placed on the glass. According to the field observation conducted by the students during the project, the users have some difficulties in removing the labels of some glass jars for the post-use phase. Therefore, they prefer products labels of which are easy to remove or products which do not have labels on the glass. Furthermore, with various cut-outs on their surfaces, the lids might serve as decorative elements for candle jars to create diverse light and shadow effects.

#### **The form of the glass**

Modifying the form of the glass packaging may provide additional functions for the product particularly for the post-use. For instance, rethinking and reforming the bottom part of the jars make them stackable, and enable users to use several jars (candle jars) at the same time. In addition to that, through changing the form of the products (e.g. bottom part) additional space may be created for placing and displaying the candle. The changes in the form of the product can also create an appealing environment for the user through creating light and shadow effects.

#### **Gravures and 2D applications**

Gravures on the glass jars seem to serve as decorative elements. Since the products are the candle jars, the gravures may create an appealing environment as the light passes thorough. Similar to gravures, 2D applications (e.g. sticker, serigraphic prints) serve as decorative elements.

#### **Product accessories**

The extra cost of the accessories is one of the reasons that why accessories are preferred in a few design ideas for the post-use phase. The accessories increase the cost of the product for the manufacturer and the price of the product for the users, which in turn can make the product undesirable for the users. On the other hand, the product accessories seem to provide additional functions for candle jars. The accessories can also be used as decorative elements to



create appealing environments. For instance, animation characters attached to the glass bottles can create diverse light and shadow effects.

Table 5.3: Design solutions for use and post-use (candle jars)


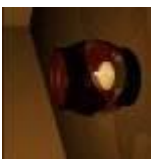












































Final product idea		Product modifications					Product accessories
		Lid	Form	Gravures	2D print		
Use	Post-use						
							
							
							
							

Table 5.3 (continued)

Final product idea		Product modifications					Product accessories
		Lid	Form	Gravures	2D print		
							
							
							
							
							

#### **5.2.4 Overall conclusions for project outcomes**

It appears that lids, the changes on the form of the products, gravures and 2D applications provide valuable opportunities for the students to design products for the post-use phase of glass packaging. The most of the product alterations has a particular emphasis on the technical and functional requirements for the water bottles. Whereas, the product modifications for the candle jars emphasize both functional and aesthetic (decorative) design requirements for the products.

The lids appear to be the most favorable strategy for the post-use phase as they can provide additional functions for both the water bottles and the candle jars. For the water bottles, the lids may help users to personalize their products, which could be very useful in public places. However, the main design consideration for the water bottles is that the lids should be protected from being thrown away or lost. As for the candle jars, the lids serve as an additional space for the labels, which in turn eliminates the requirement for removing the label from the glass surface during the post-use phase.

The surface applications are also favorable solutions for both the water bottles and the candle jars design solutions. For the water bottles, gravures provide additional functions such as preventing the covers being slipped off, and helping users grab the bottles easily. For the candle jars, the gravures serve as decorative elements when the light passes through the glass. Similar to the gravures, 2D prints create an appealing environment for the candle jars. In addition to that, 2D print applications seem to be preferable when it is not possible to change or modify other parts of the glass (e.g. lid or form of the glass), since they are easy to apply and relatively low cost.

The product accessories such as fabric covers/sleeves can be necessary for preventing the glass water bottles from being broken, and these provide additional functions like helping users grab the bottle easily and maintaining the beverage temperature (i.e. thermal insulation). Therefore, almost all of the water bottles have a cover or sleeve. On the other hand, the accessories for candle jars are not commonly preferred because they may increase the overall cost of the products significantly.

### **5.3 Interview results**

The results of the interviews will be presented in two parts. The first part consists of the interview results and conclusions for each student. A conclusion table will be used in order to present the interview results for each student. The second part consists of overall findings and conclusions drawn from the analysis of the interviews as a whole.

#### **5.3.1 Results and conclusions for each student**

Drawing general conclusions from all of the interviews may undermine the distinctive characteristics of each interview. In other words, the analysis of each interview with the ID students (i.e. case by case analysis) can reveal significant conclusions for the research, which are specific to each case. Therefore, in the conclusions tables for each student, the significant and distinctive conclusions for each case will be emphasized as well as the conclusions which are common for the majority of the interviews.

In the consent forms distributed to interviewees prior to interview, several students revealed that they did not want their name to be published, while they gave consent for the visual recordings and images of their projects (for the consent form see Appendix I). For that reason, the students will be referred as student 1, student 2 and so on, in the results and conclusions tables. Each table includes a brief definition of the student's project, the interview results associated to categories defined, and conclusions. These tables summarize the insights of the students into the design process and the design solutions developed throughout the project. Following these tables, conclusions for each student focus on the significant points or insights specific to individual interviews with the students. These conclusions have been presented in a way that similar findings and insights drawn from each interview (e.g. themes and dimensions were found useful in generating ideas) will not be repeated in order to provide a better flow throughout the thesis.

### 5.3.1.1 Student 1

#### Project description

This glass packaging is designed as a sports drink bottle (Figure 5.4). It is transformed into a water bottle through a special sleeve which is provided by the producer as a promotional accessory (Figure 5.5).



Figure 5.4: Sports drink bottle



Figure 5.5: Water bottle with fabric cover

Table 5.4: Interview results for student 1

#### 1. RESEARCH

Field observation and literature search

- **Literature search - exploration of potential product examples from the current market**

Through the literature search, the student had the chance to explore products in the current market (e.g. what were the product examples for glass packaging and post-use?).

- **The influence of the field observation**

The influence of the field observation was to some extent, since there were only two options or product categories for post-use (i.e. water bottle and candle jar).

Table 5.5 (continued)

<p><b>2. IDEA GENERATION PHASE</b></p> <p>a) Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Idea generation through considering the post-use phase first</b> Ideas were generated through considering the post-use phase because the project required it, meaning that the project specifically focused on post-use.</li><li>▪ <b>Themes and dimensions for generating ideas for post-use</b> The themes and dimensions given in the matrix exercise helped the student progress through generating ideas for the post-use phase of the product. The themes such as 'super lid' and 'super natural make up' appeared to be useful.</li></ul> <p>c) Scenario building exercise</p> <ul style="list-style-type: none"><li>▪ <b>Consideration of potential problems occurred during use</b> According to the student, the scenario building exercise was one of the most useful exercises throughout the project. The potential problems that could be emerged during usage and users' responses towards the product were considered in this exercise.</li></ul>
<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design considerations for water bottle – long lasting lid solutions</b> Long-lasting lid solutions were considered, so that users would not throw away the product after a single use (initial use as a water bottle).</li><li>▪ <b>Design considerations for water bottle - lid designed for post-use</b> The lid of the product was designed by considering the post-use phase. It was designed as a silicon stopper as it would help user to open and close the product easily when doing sports or exercises.</li></ul> <p>b) Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Alterations during transformation – use of product accessory (e.g. fabric cover)</b> After cleaning the product and removing the label, users could use the product with the fabric cover.</li><li>▪ <b>Encouragement of the user through promotional accessories</b> The fabric cover would be given as a promotional accessory to the users when buying several products at the same time. When the fabric cover being sold along with several products it would encourage users to prefer products with post-use.</li></ul>

### Conclusions for student 1

It appears that throughout the process, the literature search, themes and dimensions given in the matrix exercise and scenario building exercise are helpful. More specifically, the literature

search allows the exploration of various product examples from the market, the themes and dimensions contribute to the generation of ideas particularly for the post-use phase, and the scenario building exercise can help the student to determine and foresee potential problems occurred during the product use. However, the influence of the field observation seems to be some extent, since there are only two options or product categories for post-use ( water bottles and candle jars). In addition to that, promotional accessories such as fabric covers/sleeves for water bottles may encourage users to purchase such product. As for the design consideration for the water bottles, the most important aspect of the product seems to be the lid. The lids should resist to be thrown away or being lost, and also they should be durable enough for frequent use.

### 5.3.1.2 Student 2

#### Project Description

This glass packaging is designed as a sports drink bottle for primary use (Figure 5.6). For the post-use, the bottle can be used as a water bottle. A neoprene cover is used for protection and insulation. In addition to that, there is an area for personalization on the lid which could be helpful in public places like sports hall. Tornado gravure associated with sports drink brand is applied on the bottle (Figure 5.7).



Figure 5.6: Sports drink bottle



Figure 5.7: Water bottle with fabric cover

Table 5.5: Interview results for student 2

<p><b>1. RESEARCH</b> Field observation and literature search</p> <ul style="list-style-type: none"><li>▪ <b>Limited effects of field observation – predetermined product categories</b> The post-use product given by the tutors were determined previously (e.g. water bottle and candle jar), so according to the student's response, the field observation had no effect on the process. The product examples observed were different from water bottles and candle jars. Field observation would be more interesting if post-use products were not determined previously.</li><li>▪ <b>Inspirational examples (e.g. photo album, moneybox)</b> A bottle used as a photo album and a jar used as a moneybox.</li></ul>
<p><b>2. IDEA GENERATION PHASE</b></p> <p>a) Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Matrix exercise – focusing on a specific issue</b> The matrix exercise had helped the student to focus on a particular subject, which s/he could not achieve in the past.</li><li>▪ <b>Idea generation strategy for use and post-use phases</b> The starting point for idea generation was either use phase or post-use phase depending on the idea first came up.</li></ul> <p>b) Task exercise</p> <ul style="list-style-type: none"><li>▪ <b>Task exercise – developing product accessories and deciding on user group</b> Since the product accessories and user group were selected during this exercise, the task exercise was found helpful. For instance, offering a fabric cover for water bottle for university students was included.</li><li>▪ <b>Task exercise – generation of new ideas</b> New ideas were generated during the exercise (e.g. through modifying the label or the fabric cover).</li></ul>



Table 5.5 (continued)

<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration - the form of the product (fragility of the glass)</b> The form/shape of the product was designed through considering use phases of the bottle. For instance, when the product fell on the ground, this particular form would decrease the contact area.</li><li>▪ <b>Design consideration - plastic bumpers (fragility of the glass)</b> In addition to the shape of the product, plastic bumpers were designed for the areas which could be exposed to pressure, so that the bottle would not be broken when it fell down.</li><li>▪ <b>Design consideration – users’ preferences and fabric cover</b> Users would not want the drinks getting cold or warm, therefore an insulating material for the fabric cover was preferred.</li></ul> <p>b) Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Proposed scenario – presenting the fabric cover along with several glass bottles for decreasing of the overall cost</b> While purchasing a couple of glass bottles, the users would take the fabric cover for the water bottle. Presenting the fabric cover along with the product would increase the overall price of the product, which might make the product undesirable.</li><li>▪ <b>No reference to use phase preferred</b> As the insulation of the water bottle appeared to be an important preference for the users, reference to use phase was not offered (i.e. fabric cover wraps around the bottle).</li><li>▪ <b>Reference to use phase – conveying information about the product</b> According to student, there should be a relationship between the use and post-use phases. In addition to that, the reference of the post-use to the use phase could imply that the specific product had a post-use solution/feature.</li><li>▪ <b>Personalization – an area for personalization placed on the lid</b> With the help of the blank area on the lid, users could personalize the product so that they could easily distinguish their own product in public places (e.g. sport centers)</li></ul>
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**Conclusions for student 2**

The matrix exercise and task exercise appear to be helpful. The task exercise can help in determining the product accessories and deciding on specific user group, also during these exercises new ideas can be generated. However, the field observation seems to have no effect on the design process, since the product examples observed are different from the ones which the project brief offers. As for the design considerations, it seems that the major consideration

for the glass bottle is to prevent the bottle being broken. In doing so, the form of the product can be designed in a way that it decreases the contact area when the bottle falls down. Plastic bumpers can be used to absorb the force or impact occurred during the fall. Furthermore, the fabric covers can be used to maintain the temperature of the beverage inside the bottle. Offering a personalized area on the lids can also help users to distinguish their water bottle in crowded places such as sports centers. Moreover, when product accessories sold with several products in a promotional package, it will compensate the increase in the cost of the product. Finally, if the product refers to its use phase, this can indicate that the specific product has a post-use phase/solution.

### 5.3.1.3 Student 3

#### Project description

This glass packaging is designed as a water bottle for primary use and also for post-use. The design of this water bottle is inspired by the flow of water and the waves. The gravure applied on the inner surface of the bottle creates various light effects whereas the outer surface remains flat (Figure 5.8). The lid is connected to a pouch through an elastic rubber, which prevents the lid from being lost (Figure 5.9).



Figure 5.8: Water bottle



Figure 5.9: Water bottle with fabric cover

Table 5.6: Interview results for student 3

<p><b>1. RESEARCH</b> Field observation and literature search</p> <ul style="list-style-type: none"><li>▪ <b>Literature search - product examples not considered before (been helpful)</b> Literature search was found helpful, as the student observed product examples from the current market some of which she did not consider before.</li><li>▪ <b>Users` preferences in the products that they made themselves</b> Users liked the things/products that they made themselves, since these products had the memories of contributions they made, and the effort and the energy they invest into the product.</li><li>▪ <b>Inspirational examples (e.g. decorative candle jar)</b> A user made a candle jar through adding acetate sheets on the glass packaging.</li></ul>
<p><b>2. IDEA GENERATION PHASE</b></p> <p>a) Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Themes and dimensions - generation of ideas for post-use</b> The themes and dimensions helped the students to generate ideas systematically, implying that the idea generation process was well organized with the help of themes and dimensions.</li></ul> <p>b) Task exercise</p> <ul style="list-style-type: none"><li>▪ <b>New ideas generated during task exercise</b> New ideas can be generated during the task exercise (e.g. making the product suitable for outdoor use).</li></ul> <p>c) Scenario building exercise</p> <ul style="list-style-type: none"><li>▪ <b>Limited effect of the scenario building exercise - illustration of the scenarios considered earlier in the design process</b> The scenario building exercise had limited effect on the design solution, since the student did not generate additional ideas and made only illustrations of the ideas considered and developed earlier in the idea generation phase.</li></ul>

Table 5.6 (continued)

<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration – re-using lid and connecting it to the fabric cover</b> Since the product could be used repeatedly, the lid should not have been lost. Therefore, the student incorporated a design detail into the lid for connecting the lid to the body of the glass packaging.</li><li>▪ <b>Design consideration - durable lid for the post-use phase</b> The lid should be durable enough to be used repeatedly because many users might not want to pay for an extra lid for the post-use.</li></ul> <p>b) Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Product accessory made by the users instead of purchasing extra parts)</b> According to the student, users would not prefer to buy an extra part or accessory for the product for the post-use phase. The cover of the product could be produced by the user himself or, if desired, it could be bought from a store.</li></ul>
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### Conclusions for student 3

It appears that the literature search, and the matrix and task exercise are helpful. In particular, the themes and dimensions contribute to the generation of ideas for the use and the post-use phases during the matrix exercise. On the other hand, the scenario building exercise seems to be not useful, since the scenarios are considered and developed prior to this exercise, meaning that any additional scenario is not offered. As for the design considerations, the lid is an important product consideration for the post-use. Finally, users can make the product accessories with locally available materials such as fabrics, so that they do not pay extra money for the product accessories instead of purchasing them separately from the product.

#### 5.3.1.4 Student 4

##### Project description

This glass packaging is designed as a water bottle for use and post-use phases (Figure 5.10). For the post-use phase a neoprene cover is given with 6-packs as a promotion. This cover ensures heat isolation and protects the bottle from impacts. The handle is wrapped around the bottle, and it can be flipped upwards to carry the bottle (Figure 5.11).



Figure 5.10: Water bottle



Figure 5.11: Water bottle with fabric cover

Table 5.7: Interview results for student 4

### 1. RESEARCH

Field observation and literature search

- **Literature search - various groups various topics**

The literature search was found helpful, as various groups conducted research about various topics on which one single group could not manage to do so.

- **Field observation – various groups variety of information**

Various groups gathered variety of information during the field observation as diverse users could be observed within a short period of time.

- **Field observation results – need for insulation and resistance to breakage**

The users involved in the field observation did not prefer to use a glass bottle as a water bottle, since the bottle could be broken and the beverage could be warmed up.

Table 5.7 (continued)

<p><b>2. IDEA GENERATION PHASE</b></p> <p>a) Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Matrix exercise - idea generation</b> The matrix exercise was found helpful for the idea generation phase.</li><li>▪ <b>Themes and dimensions – initial steps for idea generation</b> The themes and dimensions were found helpful for the student. They appeared to be initial steps for the idea generation. Inspirational words (themes and dimensions) helped the student to generate various ideas.</li><li>▪ <b>Themes and dimensions – consideration of various aspects</b> The themes and dimensions helped the student consider the various aspects of the product (e.g. lid, surface etc.).</li><li>▪ <b>Idea generation strategy - idea first came up</b> The starting point for the idea generation was either the use phase or the post-use phase depending on the idea first came up.</li></ul> <p>b) Task Exercise</p> <ul style="list-style-type: none"><li>▪ <b>Task exercise – development of the ideas further</b> The task exercise was found helpful in developing the ideas generated in the matrix further.</li></ul> <p>c) Scenario building exercise</p> <ul style="list-style-type: none"><li>▪ <b>Scenario building exercise – little effect on the product solution</b> The student thought that scenario building exercise did not affect the whole product idea much. The student considered the issues like how would the product be sold, and distributed.</li></ul>
<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration - feedback through the fabric cover in terms of how much beverage left in the water bottle</b> A fabric cover associated with the shape of the glass and the gravures on its surface was designed, so that the cutouts on the cover could help the user to know how much beverage remained in the bottle.</li></ul> <p>b) Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Alterations during transformation – label not removed</b> The label of the packaging was not removed, since the users might want to show they use a particular water brand.</li></ul>

#### Conclusions for student 4

It appears that the literature search and the field observation are useful. Various groups focusing on different topics and different users are able to gather detailed information which a single group cannot do so within a short time. The results of the field observations indicates that users do not want to use glass water bottles, as the bottle can be easily broken and the beverage can either warm up or get cold quickly. Furthermore, the matrix and task exercises seem to be useful. The project themes and dimensions can be a good starting point (i.e. initial steps) for the students to generate ideas for the use and post-use phases. The themes and dimensions can also contribute to the consideration of various aspects of the products (e.g. lid, surface finishing and accessories). As for the design considerations, the fabric covers wrapping the bottle should allow users to get feedback (i.e. how much beverage left inside the bottle).

#### 5.3.1.5 Student 5

##### Product description

This glass packaging is designed as a fruit juice bottle for primary use (Figure 5.12) designed for 3-6 years old children. The glass packaging used as a juice bottle for the use phase, is turned into a water bottle with specifically designed felt coverings for post-use (Figure 5.13).



Figure 5.12: Juice bottle



Figure 5.13: Water bottle with fabric cover

Table 5.8: Interview results for student 5

<p><b>1. RESEARCH</b> Field observation and literature search</p> <ul style="list-style-type: none"><li>▪ <b>Inspirational examples – jars painted by children</b> The glass packaging examples that children decorated through painting were found inspirational.</li></ul>
<p><b>2. IDEA GENERATION PHASE</b></p> <p>a) Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Matrix exercise – consideration of post-use at the early stages of design process</b> The matrix exercise aid the student to consider the post-use at the early stages of design process (i.e. idea generation phase).</li></ul> <p>b) Task exercise</p> <ul style="list-style-type: none"><li>▪ <b>Task exercise – matching specific task with the main concept</b> The task exercise was found influential because the main concept and design solution was developed during the task exercise (e.g. developing a water bottle for 3-6 children).</li></ul> <p>c) Scenario building exercise</p> <ul style="list-style-type: none"><li>▪ <b>Scenario building exercise - consideration of the product display</b> The consideration of the product to be placed on the shelves was made during this exercise, which in turn did not make significant effect on the design solution.</li></ul>



Table 5.8 (continued)

<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration – bringing the lid and fabric cover together</b> The fabric cover and lid were brought together through a design detail (i.e. attaching the lid to the fabric cover through a rope), since the lid might be lost during use.</li><li>▪ <b>Design consideration – easy to remove labels</b> The field observations indicated that users would not prefer to use the products labels of which were hard to remove.</li><li>▪ <b>Encouraging post-use thinking from the childhood</b> The student stated that the glass packaging products should have guided the users for post-use or encouraged them to re-use the products. This awareness of post-use should have been considered in the childhood, for that reason the student had designed a post-use product for the children.</li></ul> <p>b) Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Product accessory - information about post-use</b> The product and its accessories could be sold in the same shelf so that users could understand that the product had a post-use feature. Therefore, this scenario could be useful in giving information about the post-use phase to the users.</li></ul>
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**Conclusions for student 5**

Considering the idea generation exercise, the matrix and task exercises seem to be useful. The matrix exercise helps students to consider post-use at the early stages of design process. One of the tasks in the task exercise is related to the concept idea of the student (developing a water bottle for children between 3 and 6). Therefore, the task exercise is found useful. As for the design considerations, binding the lids and fabric covers with a rope can prevent the lids being lost. Moreover, when the product accessories being sold along with the product (e.g. in the same shelf in the markets), this may encourage users to purchase the product accessory and also indicates that the product has a particular post-use solution. Finally, designing post-use product for children can also increase their awareness of environmental issues.

### 5.3.1.6 Student 6

#### Product description

This glass packaging is designed as a fruit juice bottle for primary use (Figure 5.14). For the post-use the bottle can be used as a water bottle. After cleaning out the label, the bottle can be used with or without the cover (Figure 5.15).



Figure 5.14: Juice bottle



Figure 5.15: Water bottle with fabric cover

Table 5.9: Interview results for student 6

#### 1. RESEARCH

Field observation and literature search

- **Field observation results – users' tendency to re-use the products they like**  
The users participated in the observation preferred to keep the products that they liked most.
- **Field observation results – products with labels hard to remove**  
The field observations indicated that the users did not want to use glass packaging labels of which were hard to remove.

Table 5.9 (continued)

<p><b>2. IDEA GENERATION PHASE</b> Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Matrix exercise – difficulty in generating ideas</b> The student had difficulties in generating ideas for the matrix exercise. In particular, the student thought that predetermining post-use product categories as water bottles and candle jars constrained the student's ability to develop creative solutions for use and post-use.</li></ul>
<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration- association of fabric cover and the product</b> The product accessory (fabric cover) should appear as if in fact belonging to the product. In other words, the form of the product and the fabric cover should complement each other.</li></ul> <p>b) Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Product accessory – fabric cover not being sold along with the product</b> Selling the product accessory along with the product was not reasonable, since users might not want to use the product as water bottle.</li><li>▪ <b>No reference to use phase – users' preferences on removing the labels</b> The product did not refer to its use phase through labels, as the users would not want to re-use products with labels.</li><li>▪ <b>No Reference to use phase – a new product considered for the post-use</b> The post-use product should appear to be a 'new' product rather than simply a re-use of an ordinary bottle.</li></ul>

### Conclusions for student 6

The field observation results indicate that users have a tendency to re-use the products that they admire, and they do not want to use the products labels of which are hard to remove. Although the student has some difficulties in generating ideas, the themes and dimensions are helpful as they help the student to consider various aspects of the product such as lids and accessories. As for the product accessory, the fabric covers and the (glass) water bottle should complement each other in terms of form. The reason why product accessory can be sold separately is that the users may not want to use the product for post-use. For instance, they may use the bottle as a juice bottle and then throw it away or use the bottle as another product. Finally, the reason why reference to use phase is not offered is that the users would not want to

re-use products with labels, and the post-use phase appears as a new product thus it should look like a new product.

### 5.3.1.7 Student 7

#### Project description

This glass packaging is designed as an olive oil bottle for primary use (Figure 5.16). For the post-use, the bottle can be used as a water bottle in office environments. If preferred by the users, leather covers can be used in order to protect the glass packaging (Figure 5.17).



Figure 5.16: Olive oil bottle



Figure 5.17: Water bottle with fabric cover

Table 5.10: Interview results for student 7

#### 1. RESEARCH

Field observation and literature search

- **Inspirational examples (e.g. toothbrush container, container for sewing, photo display)**

Users used glass jars as a container for toothbrushes, containers for sewing, and as a photo display.

Table 5.10 (continued)

<p><b>2. IDEA GENERATION PHASE</b> Scenario building exercise</p> <ul style="list-style-type: none"><li>▪ <b>Illustration of the scenarios considered before – improvement of the previous ideas</b> Making illustrations of the scenarios considered and developed at the beginning of the project had helped student to improve these scenarios. In other words, when these scenarios were illustrated in paper, the student was able to see the missing parts that s/he did not consider before.</li></ul>
<p><b>3. FINAL PRODUCT IDEA</b> Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration - easy grip and place for labeling</b> The gravure embedded on the product surface served as a place for labeling for the use and the post-use phases, and it allowed user to grab the bottle easily.</li></ul>

### Conclusions for student 7

The matrix, task and scenario building exercises seem to be useful. More specifically, during the scenario building exercise where the scenarios considered and developed at the beginning of the project were illustrated in paper, the student was able to see the missing parts that s/he did not consider before. As for the design considerations, the form of the water bottle should provide a space for the label and also for easy grip.

### 5.3.1.8 Student 8

#### Project description

This glass packaging is designed as a rakı bottle for primary use. The rakı bottle inspired by the concept of “rakı-fish” is used as a water bottle in the post-use phase (Figure 5.18). For the post-use the bottle can be used as a water bottle in domestic environments. If preferred by the users, cotton covers can be used (Figure 5.19).



Figure 5.18: Raki bottle



Figure 5.19: Water bottle

Table 5.11: Interview results for student 8

<p><b>1. RESEARCH</b> Field observation and literature search</p> <ul style="list-style-type: none"> <li>▪ <b>Re-use of glass packaging by users – aesthetically pleasant ones</b> Users wanted to preserve and re-use the glass packaging products that they found aesthetically pleasant.</li> </ul>
<p><b>2. IDEA GENERATION PHASE</b> Matrix exercise</p> <ul style="list-style-type: none"> <li>▪ <b>Matrix exercise - some ideas not fitting within the matrix cells</b> The matrix exercise was found limiting, since some ideas generated could not fit within the cells of the matrix.</li> <li>▪ <b>Idea generation strategy – consideration of use phase first and then post-use</b> The ideas for use phase were developed first, and then potential solutions for the post-use phase were considered during matrix exercise.</li> </ul>
<p><b>3. FINAL PRODUCT IDEA</b> Use and post-use phases</p> <ul style="list-style-type: none"> <li>▪ <b>Design consideration – hiding the label through cover</b> The fabric cover could hide the label on the glass.</li> </ul>

### Conclusions for student 8

The field observation results indicate that the users have a tendency to re-use the product that they have found aesthetically pleasant. However, some ideas generated during the exercise did not associated with the specific themes and dimensions which seems to be limiting for the students. The fabric cover can be used to hide the label on the glass when the label of the product is hard to remove such as serigraphic print application.

### 5.3.1.9 Student 9

#### Project description

This glass packaging is designed as a milk bottle for the primary use (Figure 5.20). The milk bottle is transformed into a personalized water bottle for kids through face stickers on the lid, speech bubbles on the main body and its special cover (Figure 5.21).



Figure 5.20: Milk bottle



Figure 5.21: Water bottle

Table 5.12: Interview results for student 9

<p><b>1. RESEARCH</b> Field observation and literature search</p> <ul style="list-style-type: none"><li>▪ <b>Field observation results – users’ positive opinions about post-use</b> The users involved in the field observation had a positive attitude towards post-use, and they had a tendency to re-use the glass packaging products.</li></ul>
<p><b>2. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>The effect of use and post-use – balancing the post-use feature with the overall cost</b> For instance, the lid options for the post-use would increase the overall cost of the product, thus the variety of these lids was reduced to a minimum.</li></ul> <p>b) Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Personalization through various stickers applied on the design</b> Users could personalize the product through stickers.</li></ul>

### Conclusions for student 9

The more the product accessories are offered for the post-use the more the cost of the product is increased. Therefore, when considering use and post-use phases concurrently, a compromise between two phases should be sought. For instance, decreasing the number of accessories can be a solution for this problem. Various stickers can be used to personalize the water bottles, which appears to be a significant design contribution for this solution in comparison with the rate of personalized design solutions in other projects.

### 5.3.1.10 Student 10

#### Project description

This glass packaging is designed as a honey jar for primary use (Figure 5.22). The body of the glass packaging is flocked in order to transform it into a water bottle. This surface application enables the user to personalize the bottle and satisfies functional needs such as insulation. The polypropylene cap is used to drink water during post-use (Figure 5.23).





Figure 5.22: Honey jar



Figure 5.23: Water bottle

Table 5.13: Interview results for student 10

### 1. IDEA GENERATION PHASE

#### b) Task exercise

- **Improvement of the ideas generated in matrix exercise**

Task exercise helped the student to further improve the ideas that s/he generated. For instance, developing design details for the user group (i.e. 3-6 year old children).

#### c) Scenario building exercise

- **Scenario building exercise - generation of new ideas**

New ideas could be generated during the scenario building exercise. For example, the idea of using the jar cap as serving honey was generated during this exercise.

Table 5.13 (continued)

<p><b>2. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design considerations for water bottle (e.g. thermal insulation, impact absorbance, easy grip)</b> The specific coating for this post-use phase would provide thermal insulation, increase the impact absorbance and the friction, in turn provide an easy grip.</li><li>▪ <b>Design considerations for water bottle (e.g. volume)</b> When designing glass water bottle (being previously a honey jar), the size of the water bottle should be adequate, so that it would be worth carrying with.</li></ul> <p>b) Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Proposed scenario - coating application in a small-scale workshop</b> For the post-use, the product would be delivered to a factory/small scale workshop to apply a special coating (flock) onto the product, as the user could not apply this coating on his/her own.</li><li>▪ <b>No Reference to use phase - encouraging the variety of uses</b> Reference to the use phase was removed, so that the variety of the places or conditions where this product used could be extended.</li></ul>
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### Conclusions for student 10

It appears that all of the idea generation exercises are helpful. The task exercise helps student to improve the ideas developed in matrix exercise further. During the scenario building exercise new ideas can be generated for example using the jar cap as serving honey. As for the design considerations for water bottle, the water bottle should have thermal insulation and impact absorbance, and provide easy grip. The flock coating can be an alternative solution to achieve these considerations. Another important aspect of the water bottle seems to be the size and the volume of the bottle. Since it is a commercial product, it should have enough volume for storing and serving beverage so that it will be worth carrying. When there are certain applications such as flock coating, the users has to bring the product to a small-scale manufacturer (within this project context) for transforming the product into a water bottle. In order to increase the variety of the places where the product used, the reference to use phase is removed.

### 5.3.1.11 Student 11

#### Project description

This glass packaging is an instant coffee and milk powder jar. It consists of three parts. Milk powder is stored in the top part and instant coffee in the bottom part. The cap of the packaging is designed to serve instant coffee and milk powder at the same time (Figure 5.24). For the post-use phase, the packaging can be used as a water bottle. The product enables the user to carry two different drinks at the same time. Furthermore, drinks can be cooled down by putting ice in the top part of it (Figure 5.25).



Figure 5.24: Coffee jar



Figure 5.25: Water bottle

Table 5.14: Interview results for student 11

#### 1. RESEARCH

Field observation and literature search

- **Limitation of the field observation conducted with close friends**

The field observation was not helpful, since the observations were made with close friends and people around of the researcher or student. Familiar answers that the researcher had already known were given during the observations, which did not make useful contributions to the design solution.

Table 5.14 (continued)

<p><b>2. IDEA GENERATION PHASE</b></p> <p>a) Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Abandoning the ideas not fitting in any matrix cell</b> When an idea did not fit in the specific area (a matrix cell), it was abandoned. The themes and dimensions would have been more flexible (e.g. "It would be better for us to choose or write it down our own dimensions or themes").</li></ul> <p>b) Task exercise</p> <ul style="list-style-type: none"><li>▪ <b>Task exercise - developing independent ideas</b> The task exercise did not make significant contribution to the idea generation phase. The student developed the ideas independent from the task exercise, and tried to tailor these ideas to the tasks given.</li></ul>
<p><b>3. FINAL PRODUCT IDEA</b></p> <p>Proposed scenarios for the final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Proposed scenario - a coffee mug containing coffee and coffee-mate inside</b> The product should not refer to an ordinary bottle to drink water. It should refer to a coffee mug. Users should buy this water bottle with coffee inside and use as a mug to drink water.</li><li>▪ <b>Personalization - user involvement in making and customizing the fabric cover</b> The product accessory was a simple cover which users could easily produce/make it themselves, allowing them to make more personalized product.</li></ul>

### Conclusions for student 11

The field observation seems to be not useful, since the observations are made with close friends or people around the student. The answers appear to be familiar ones that the student has already known. The task exercise seems to be not useful. The ideas are first generated independent from the task exercise, then modified in accordance with tasks given. Finally, the product can be personalized through fabric cover made by users.

#### 5.3.1.12 Student 12

##### Project description

This glass packaging is designed as baby food jar for primary use (Figure 5.26). For the post-use the baby food jar can be transformed into a feeding bottle through promotional accessories (Figure 5.27).



Figure 5.26: Baby food jar



Figure 5.27: Baby feeder

Table 5.15: Interview results for student 12

<p><b>1. RESEARCH</b> Field observation and literature search</p> <ul style="list-style-type: none"> <li>▪ <b>Inspirational examples (e.g. olive oil feeder)</b> Bottles of which openings had various sizes could be used as olive oil feeder with the help of an accessory.</li> </ul>
<p><b>2. FINAL PRODUCT IDEA</b> Use and post-use phases</p> <ul style="list-style-type: none"> <li>▪ <b>Design consideration- circular shape for post-use (easy grip)</b> The influence of the use and post-use phase could be seen in the shape of the product. For instance, the circular shape at the bottom of the product was designed considering the post-use (i.e. circular shape can help users to grip the baby feeder easily).</li> <li>▪ <b>Design consideration - 2D print applications for post-use (certain specifications for the baby food jar)</b> Since the product had certain specifications, it was hard to make modifications in the form of the product. Therefore, 2D print applications (e.g. serigraphic print) were preferred for making the product appealing for the children.</li> </ul>

### Conclusions for student 12

When the use phase of the product has certain product specifications or regulations (such as baby food containers); it would be better to offer 2D print applications (e.g. serigraphic prints) for the post-use phase.

#### 5.3.1.13 Student 13

##### Project description

This glass packaging is designed as coffee jar for primary use. The plastic cap of the product is specialized for pouring the instant coffee (Figure 5.28). For the post-use, the label on the glass packaging is removed and the print under the label is revealed. The jar is filled with candle wax and used as a candle jar (Figure 5.29).



Figure 5.28: Coffee jar



Figure 5.29: Candle jar

Table 5.16: Interview results for student 13

#### 1. RESEARCH

Field observation and literature search

- **Literature search - consideration of literature search findings throughout the project**

According to the student, the literature search was useful; since the findings from the literature search were considered throughout the project (e.g. the research was on various types of lids in glass packaging).

Table 5.16 (continued)

<p><b>2. IDEA GENERATION PHASE</b> Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Matrix exercise – saving time</b> The matrix exercise helped student to develop ideas within a short time.</li><li>▪ <b>Themes and dimension - focusing on a specific issue</b> The themes and dimensions helped the student to focus on a special topic when generating ideas. For instance, the theme ‘super lid’ helped the student focus on the lid.</li></ul>
<p><b>3. FINAL PRODUCT IDEA</b> Proposed scenarios for final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Alterations during transformation - serigraphic print under the label</b> Removing the label would reveal a serigraphic print underneath.</li><li>▪ <b>No reference to use phase – maintaining the product value as a candle jar</b> Reference to the use phase was removed, since the product would lose its value as a candle jar if it referred to its use phase.</li><li>▪ <b>No personalization - solutions considering wide range of user group</b> Any personalization scenario was not offered for the product to keep the user group as broad as possible.</li></ul>

### Conclusions for student 13

The themes and dimensions appear to be useful since it helps the student to focus on a specific issue, and to develop ideas for use and post-use phases within a short time (i.e. saving time). Reference to the use phase is removed because the product may lose its value as a candle jar. Lastly, product personalization is not offered so that a wider user group can use the product.

#### 5.3.1.14 Student 14

##### Project description

This glass packaging is designed as a Turkish coffee jar for primary use (Figure 5.30). After the use phase the coffee jar is transformed into a candle jar appropriate both for tea light and custom-made candles. The jar can be personalized through various prints and stickers (Figure 5.31).



Figure 5.30: Coffee jar



Figure 5.31: Candle jar

Table 5.17: Interview results for student 14

<p><b>2. IDEA GENERATION PHASE</b></p> <p>a) Matrix exercise</p> <ul style="list-style-type: none"> <li>▪ <b>Themes and dimensions – the suitability of the idea to the matrix cell</b> Each theme and dimension could not be applicable to the ideas generated. In other words, the students in some cases could not find any suitable place for the idea s/he generated in the matrix cells constituted by the themes and dimensions.</li> </ul> <p>b) Task exercise</p> <ul style="list-style-type: none"> <li>▪ <b>Task exercise – limited contribution (the need for ideas different from matrix exercise)</b> The contribution of the task exercise was limited. According to the student it would have been better to develop independent ideas from the matrix exercise.</li> </ul>
<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"> <li>▪ <b>Design consideration – product form (e.g. cubical shapes and flat surfaces)</b> The cubical shape of the product could provide enough space for the labels and stickers, also this kind of shape could have advantages in terms of stacking the products.</li> </ul> <p>b) Proposed scenarios for final product idea</p> <ul style="list-style-type: none"> <li>▪ <b>Promotion of the product in stores or cafés – displaying the post-use solution by coffee producer</b> The company (in that case coffee producer) could promote the product through exhibiting the product (i.e. the post-use product candle jar) in stores like cafés, and encourage users to purchase the product.</li> </ul>



### **Conclusions for student 14**

In some situations the ideas developed in the matrix exercise are not suitable for a specific matrix cell (e.g. super lid, locally inspired). The task exercise appears to make a limited contribution to the idea generation phase, it would be better to use different ideas from the ideas developed for the matrix exercise. As for the design considerations for the candle jar, the product is designed as a simple cubical form with flat surfaces. The cubical shape can be helpful in stacking and packaging the product, whereas flat surfaces can provide space for labels and also 2D prints applied for the post-use. Finally, promotion of the post-use products in specific stores (in this case cafés) can illustrate the post-use in real time to the users, which can encourage them to purchase the product.

### **5.3.1.15 Student 15**

#### **Project description**

This glass packaging is designed as a coffee jar for primary use (Figure 5.32). The product can be turned into a candle jar when the lids are reversed (Figure 5.33).



Figure 5.32: Coffee jar



Figure 5.33: Candle jar

Table 5.18: Interview results for student 15

<p><b>1. RESEARCH</b> Field observation and literature search</p> <ul style="list-style-type: none"><li>▪ <b>Literature search – materials of the present lids</b> Through the research the materials of the lids in the present market were explored in detail.</li></ul>
<p><b>2. IDEA GENERATION PHASE</b> Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Themes and dimensions – limiting matrix cells for idea generation</b> The themes and dimensions were found limiting, since the student was expected to develop ideas for specific matrix cells (e.g. transformable, my natural make-up). According to him/her, it would be better to develop ideas within a broader perspective.</li></ul>
<p><b>3. FINAL PRODUCT IDEA</b> Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration – cutouts on the lid of the jar allowing candle to burn</b> The cutouts on the lid of the jar had to be not closed during use, so that candle could burn.</li><li>▪ <b>Design consideration – re-using the lid instead of throwing it away</b> The lid of the product was used in the post-use phase instead of being thrown away.</li></ul>

### Conclusions for student 15

The literature search seems to be useful, since the variety of materials used for the production of lids is explored. The themes and dimensions appear to be limiting for the student because the ideas are developed in accordance with the specific themes and dimensions for example transformable, my natural make up, instead of developing independent ideas from these words (i.e. themes and dimensions). As for the design considerations, the significant feature is that the opening of the jar should be open enough so that the candle can be burnt. In addition to that, the lid has an important role for post-use as a decorative component; therefore it is reused in the post-use phase instead of thrown away.

### 5.3.1.16 Student 16

#### Project description

This glass packaging is designed as a honey jar for its primary use. It has two lids which are snap-fit inner lid and silicon outer lid (Figure 5.34). For the post-use, the candle jar can be configured in three different ways. The jar can be filled in with wax or a tea-light candle would be placed into the jar. The silicon lid can also be placed at the bottom of the jar (Figure 5.35).



Figure 5.34: Honey jar



Figure 5.35: Candle jar

Table 5.19: Interview results for student 16

#### 1. RESEARCH

Field observation and literature search

- **Literature search - designing a honey jar**

The literature search topic with a focus on glass jars was useful, since the student designed a honey jar throughout the project.

- **Literature search – limitation of the predetermined product categories**

The literature search would be more inspirational, if post-use product categories were not determined by the tutors.

- **Inspirational examples (e.g. sewing box, toothbrush holder)**

The users in that research transformed glass jars into sewing box/container and some used glass jars as toothbrush holders.

Table 5.19 (continued)

<p><b>2. IDEA GENERATION PHASE</b> Task exercise</p> <ul style="list-style-type: none"><li>▪ <b>Unrelated tasks to the design ideas</b> The task exercise was found not very helpful, since the tasks given in the exercise were not related to what the student intended to do for the project</li></ul> <p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration - safety lid designed through considering post-use (e.g. decorative cut-outs)</b> The holes on the safety lid were influenced by the post-use phase of the product (i.e. when it was used as a candle jar, the holes or cut-outs on the lids functioned as a decorative part).</li><li>▪ <b>Design consideration - the suitability of gravures and safety lid</b> The gravures on the jar could permit safety lid to be placed under the jar.</li><li>▪ <b>Difficulty of balancing use and post-use phases during idea generation</b> The balance between the use and the post-use phase was hard to achieve when generating ideas.</li></ul> <p>b) Proposed scenarios for final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Alterations during transformation – safety lid as a decorative element</b> When the safety lid was removed, the aluminum lid was revealed. For the post-use, the safety lid then could be placed under the jar.</li><li>▪ <b>Personalization through painting</b> The safety lid could be painted (if desired), and little stones and flowers could be put inside the jar to make it a more personalized product.</li></ul>
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### Conclusions for student 16

According to the student the literature search may be inspirational when the products are not predetermined. Since the candle jars are decorative objects, the product parts such as lids can play a role in creating appealing environments. For instance, the lid of the product with various cut-outs on it can create such environment through various shadow and light effects. When a product part (e.g. lid) can be placed under the jar, the gravures on the jar and the lid should fit together. It appears that balancing the use phase and post-use phase is hard to achieve, either use or post-use phase can be stood out in the product. The product can be personalized through painting the jar or adding some decorative stones into the jar.

### 5.3.1.17 Student 17

#### Project description

This glass packaging is designed as a honey jar for primary use (Figure 5.36). For the post-use the bottle can be used as a candle jar. The candle jar may be filled with sand, colorful stones etc. The jar is turned up-side down and a candle within the radius of 75-80 mm is placed (Figure 5.37).



Figure 5.36: Honey jar



Figure 5.37: Candle jar

Table 5.20: Interview results for student 17

<p><b>1. RESEARCH</b> Field observation and literature search</p> <ul style="list-style-type: none"><li>▪ <b>Field observation results – users` preferences on removing labels</b> The field observations indicated that users did not prefer to use products labels of which are hard to remove. When they used the glass packaging as a food and beverage container they might prefer to use the label on the glass. However when they used the glass packaging as a decorative object, they did not want to keep the label on the glass.</li></ul>
<p><b>2. IDEA GENERATION PHASE</b> Task exercise</p> <ul style="list-style-type: none"><li>▪ <b>Task exercise considered as completion of an assignment</b> The task exercise was not found very helpful, since it was regarded as a completion of an assignment.</li></ul>

Table 5.20 (continued)

<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>The effect of post-use on use phase – the cavity at the bottom of the glass</b> The cavity at the bottom of the product was designed specially for post-use. This had influenced the type of the food served in the jar and also the form of it (e.g. the food was honey for its high viscosity and the form was circular considering the current production capability of glass packaging industry).</li></ul> <p>b) Proposed scenarios for final product idea</p> <ul style="list-style-type: none"><li>▪ <b>No reference to use phase – users’ preference on new products</b> Reference to use phase was removed, since users would prefer completely new products when they used these products as decorative objects (field observation results).</li></ul>
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### **Conclusions for student 17**

The field observation results suggest that the users do not want to use products labels of which hard to remove, particularly when they use the jars as decorative objects such as candle jars. It seems that the post-use phase can effect the use phase. For instance, the cavity at the bottom of the glass is designed for the post-use phase (i.e. for placing the candle).

### **5.3.1.18 Student 18**

#### **Project description**

This glass packaging is designed as a jam jar for primary use (Figure 5.38). For the post-use the jar can be used as a candle jar. The lid of the product allows air to go inside and out so that the candle keeps burning. The lid also enables the user to use several products at the same time as candle jars (Figure 5.39).



Figure 5.38: Jam jar



Figure 5.39: Candle jar

Table 5.21: Interview results for student 18

## 1. RESEARCH

Field observation and literature search

- **Literature search – environmentally friendly production of glass (e.g. gravure applications)**

The literature search revealed that the current production techniques for glass packaging had detrimental effects on the environment. For that reason, the student chose gravure applications which were more environmental friendly surface applications compared to others (e.g. frosting, coatings, 2D print applications etc.).

- **Field observation results – users' tendency to modify and personalize the products**

The field observation indicated that user wanted to modify and personalize the products.

- **Inspirational examples from field observations – candle jar painted in a gradient way**

To exemplify the research findings, a user painted the glass in a way that the paint appeared to be lighter towards the upper part of the glass, and s/he used this glass as a candle jar.

- **Field observation results – users' preferences versus designers' intent**

The field observation results suggested that users might not use the products as designers predicted and suggested. For instance, the user might want to use the glass jars as a food container instead of using as a candle jar.

Table 5.21 (continued)

<p><b>2. IDEA GENERATION PHASE</b></p> <p>a) Matrix exercise</p> <ul style="list-style-type: none"><li>▪ <b>Matrix exercise – development of various and many ideas</b> The matrix exercise was found helpful as it could prevent the student from focusing on a single idea. Particularly, without matrix exercise the variety and the number of the ideas generated would be low.</li><li>▪ <b>Difficulties in generation of ideas for use and post-use concurrently</b> The student had some difficulties in considering and developing ideas for post-use and use phases concurrently.</li></ul> <p>b) Scenario building exercise</p> <ul style="list-style-type: none"><li>▪ <b>Scenario building exercise applied on a detailed design solution</b> During the exercise the details of the product idea was almost finished. Therefore, the scenario building exercise had no effect on the product as a whole.</li></ul>
<p><b>3. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Use and post-use – the effect on the product shape (e.g. the indent in the glass for stacking, semi open lid for air circulation)</b> The detachable part placed on the lid helped to maintain candle lighting. This feature was specifically designed for the post-use. The bumps on the top of the lid and the indents on the bottom of the glass were designed for enabling user to use several glass jars at the same time and stacking them easily.</li></ul> <p>b) Proposed scenarios for final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Alterations during transformation into post use phase – displaying several products together</b> Several jars could be used at the same time through stacking them together.</li></ul>

### Conclusions for student 18

The literature search reveals that the gravure applications are more environmentally friendly options than the other surface applications such as frosting, coating or 2D print applications. For this particular reason, the gravures are preferred for the surface applications. The field observation results suggest that the users have a tendency to modify and personalize the products. The observations also indicate that the users' preferences can be different from designer's initial intent. For example, the users may use the glass jars as food containers instead of using it as a candle jar. Furthermore, the student seems to have some difficulties in generating ideas for use and post-use phases. The scenario building exercise has no effect on



the product because the product is almost completed during this exercise. Using several candle jars at the same time can create appealing environments through various light and shadow effects.

### 5.3.1.19 Student 19

#### Project description

This glass packaging is designed as a single-use jam jar for high-end hotels for primary use (Figure 5.40). For the post-use the bottle can be used as a candle jar. The product is transformed into a candle jar through using alternative accessories (Figure 5.41).



Figure 5.40: Jam jar



Figure 5.41: Candle jar

Table 5.22: Interview results for student 19

#### 1. RESEARCH

Field observation and literature search

- **Field observation – users' limited vision of post-use**

The field observation results indicated that considering the re-use of glass packaging products, the users mostly use these products for food storage.

- **Field observation results – re-use of glass jars as jam jars in the breakfast table**

The field observation results revealed that the users generally used the glass jars as jam jars. Therefore, the use phase of the product was designed to be reused in the breakfast table.

Table 5.22 (continued)

<p><b>2. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Use and post-use – the effect on the product shape (e.g. the indent in the glass, lid used as a base for post-use)</b> The effect of use and post-use phases was on the shape of the product. The indents in each glass jar allowed several products could be put together. Furthermore, the indents allowed product accessories to be placed into the glass. The lid could be used as the base for the candle jar.</li></ul> <p>b) Proposed scenarios for final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Promotional product for use phase – accessory sold in markets</b> Since the product as jam jar could not be available for domestic use (i.e. it was a promotional product which the hotels offered to the users), the accessories could be offered separately in other stores for glassware. Either accessory could be put inside the product or the product could be placed in the accessories.</li></ul>
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### **Conclusions for student 19**

The field observation results indicate that the users have limited vision of post-use in terms of reusing the glass packaging products (i.e. they re-use the glass packaging as food and beverage containers). The results also reveal that the users re-use glass jars as jam jars in breakfast table. For that reason, the student appears to design the product to be used in the breakfast table. It appears that all of the idea generation exercises are useful. As for the design considerations, the indents in the glass jars allow several jars to be used at the same time. Furthermore, the lid can be used as a base for the candle jar.

### **5.3.1.20 Student 20**

#### **Project description**

This glass packaging is designed as a yogurt jar for the primary use. The gravures on the glass packaging help hiding undesirable exposure of the product content at the bottom of the jar (Figure 5.42). For the post-use, the jar can be used as a candle jar. The gravures create attractive lighting effects in the post-use phase. The configuration of multiple units creates more attractive lighting effects (Figure 5.43)



Figure 5.42: Yogurt jar



Figure 5.43: Candle jar

Table 5.23: Interview results for student 20

### 1. FINAL PRODUCT IDEA

#### a) Use and post-use phases

- **Design consideration - gravures as functional and decorative parts of the design solution**

The product was designed to be functional and decorative (a meaningful/suitable form for the post-use) through modifying the form of the product. To illustrate the gravures on glass surface concealed the deterioration of the yogurt (functional) and for the post-use this gravures could create shadow and light effects (decorative).

- **Design consideration – a particular place for placing the label on the lid**

The label was placed on top of the lid instead of on the glass surface because the users might not want to use the products labels of which could not be removed.

#### b) Proposed scenarios for final product idea

- **Alterations during transformation – several jars together creating light and shadow effects**

Through placing the jars next to each other on the self, the light and shadow effects could occur due to the gravures on the glass

### Conclusions for student 20

For the design considerations, the product should be designed so that it will be both functional and decorative product. The gravures on the glass can not only hide the deterioration of the yogurt but also create various light and shadow effects when several products are put together. Furthermore, the label can be placed onto the lid instead of placing it on the glass surface,

which users do not prefer when they re-use the glass packaging products (field observation results).

### 5.3.1.21 Student 21

#### Project description

This glass packaging is designed as a spice jar for the primary use (Figure 5.44). For the post-use the bottle can be used as a candle jar. When the candle burns, the propeller begins to spin and animation characters attached to the propeller create light and shadow effects (Figure 5.45).



Figure 5.44: Spice jar



Figure 5.45: Candle jar

Table 5.24: Interview results for student 21

#### 1. IDEA GENERATION PHASE

Matrix exercise

- **Matrix exercise – the development of final product idea**  
The matrix exercise helped the student to develop the final product idea.

Table 5.24 (continued)

<p><b>2. FINAL PRODUCT IDEA</b></p> <p>a) Use and post-use phases</p> <ul style="list-style-type: none"><li>▪ <b>Design consideration- the effect of post-use on the size of the product</b> The post-use phase of the product affected the dimensions and the size of the product. Product accessories for the post-use could increase the cost and price of the product. Therefore, the size of the product was increased to compensate the additional costs.</li></ul> <p>b) Proposed scenarios for final product idea</p> <ul style="list-style-type: none"><li>▪ <b>Product accessory – propeller and animation characters</b> The product accessories could be sold with the product. While burning the candle, the accessories included the propeller would start spinning, and consequently animation characters attached to the propeller would create various light and shadow effects.</li></ul>
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### **Conclusions for student 21**

The matrix exercise appears to be helpful, since the student develops final product idea during this exercise. The post-use phase seems to affect the dimensions/size of the product. The size of the product is increased to compensate the additional costs stemming from product accessories for the post-use. The propeller and animation characters are used as accessories for the candle jars, which can create various light and shadow effects.

### **5.3.2 Interview results for manufacturer**

#### **5.3.2.1 Chief mould design manager: Tamer Öztürk**

##### **Current projects about sustainability**

There are currently two projects that the firm is currently working on. The first project is namely 'ultra light bottles'. The main idea of this project is to develop ultra light and durable bottles through using minimum material. The second project is about producing double life products such as jars which can be used as jam and/or honey cups for their second life. The second project has not finished yet, the company still deals with the research and development phase of this project.

##### **Recovering the glass packaging products for recycling**

Considering Turkey, the amount of glass packaging products recycled seems to be rather low. The collection of glass packaging products for recycling cannot be done effectively due to

inadequate infrastructures for collecting the glass, and inefficiency of the institutions (e.g. municipalities) responsible for the collection of the glass packaging products.

### **Post-use design thinking**

The interviewee seems to have positive attitude towards the post-use design thinking. The company is currently working on a project related to post-use, producing a food jar which can be used as jam jar for post-use, although this project is still in progress for the research and development phase.

### **Product solutions**

Two aspects of the product solutions seem to be significant. Firstly, the product accessories particularly fabric covers or sleeves can be useful to prevent glass bottles being broken, and to encourage users to purchase such products, since users may not want to use glass water bottles due to the fragility of glass. Secondly, the solutions such as labels which can be easily removed and the 2D print applications revealed when the labels are removed are also found useful, as users do not want to reuse a product with labels on it.

According to the interviewee, there are two projects found outstanding among the others. The first is the spice-candle jar designed by student 21. The second one is coffee-candle jar designed by student 11. The common feature that these product solutions share is that they offer additional functions to the user. For instance, with the help of an accessory (a propeller and animation characters) spice-candle jar can create an appealing environment through spinning of the propeller and those characters. The coffee-candle jar offers two products in one (i.e. coffee and milk powder). This packaging can provide users with additional savings as they can get two products at the same time with less money. In addition to that, this product is easy to store and easy to transport than storing or transporting two different products. In conclusion, additional functions can create added value for users and producers.

### **Proposed scenarios**

Proposed scenarios for the product solutions are selling the product accessory along with the product, selling the accessory separately in some stores and delivering the product to a small scale manufacturer for the post-use phase. According to the respondent, the scenarios offered for the post-use can be applicable in terms of funding and time.

### **5.3.2.2 Industrial designer: Oya Şenocak Akman**

#### **Sustainability and design**

According to the industrial designer, the notion of classic design seems to be favorable in terms of sustainability. Classic designs can be used for long periods of time through resisting any fashion and technological changes. Therefore, they have great importance in terms of sustainability. In addition to that, any reduction in the use of the natural resources in production can make various contributions to decrease environmental degradation. In short, classic design and resource efficiency might be favorable for sustainability.

#### **Post-use design thinking**

Interviewee has a positive attitude towards the post-use design thinking. However, the interviewee stated that consideration of user behavior can be significant in terms of post-use. In particular, users make the last decisions to purchase and not to purchase the product. In order to be economically viable, the company should sell the products. Therefore, user behaviors should also be taken into account when considering the post-use aspect of products.

#### **Design process (use and post-use phases)**

During the idea generation, use and post-use phases should be considered in accordance with each other. Yet, the product is a packaging at all, and it should fulfill the requirements of glass packaging products (adding value to a brand, easy to store and transport etc.). According to the designer, the consideration of post-use should be secondary. Since the post-use is determined or influenced by the use phase, the resulting product (i.e. post-use product) can not be original. In summary, the use phase seems to be influential during the design process because the product should fulfill the relevant requirements for a glass packaging.

#### **Proposed scenarios**

Scenarios offered for the product solutions seem to be hard to achieve, since the major consideration for companies related to such scenarios is the cost of the product and its additional services. It seems feasible to offer a scenario where the product accessories can be sold along with the product in promotional packages. This can also encourage users to purchase the product. When the product accessories can be sold separately in a store, it can not be feasible, since users do not want to pay extra money. In addition to that, to make such a scenario feasible the number of the stores selling the accessories should be increased and extended in order to accommodate various users' needs and preferences.

## **5.4 Overall conclusions for the primary research**

### **5.4.1 Research**

#### **Literature search**

The literature search appears to be useful for the students in various ways. These are:

- the exploration of potential product examples that are not considered before
- the environmentally conscious production methods of glass packaging and the alternative materials (e.g. fabric, leather, cotton, plastic etc.) used for the product accessories.

Furthermore, it appears to be helpful as the student groups are able to conduct research on various topics leading to a detailed research. On the other hand, some students stated that it would be more inspirational that if the product categories were not determined before the literature search.

#### **Field observations**

The field observations are found helpful, as the students working in groups are able to make observations with various and diverse places and users. According to the students the influence of the field observations seems to be to some extent. In other words, the field observations have little effect on the idea generation phase, since users participated in field research observations have different product examples (i.e. food containers) from the products offered by the project brief (i.e. water bottle and candle jar). Although the students stated so, the field observations could affect the idea generation phase directly or indirectly. For instance, the statement that “the users do not want to re-use the glass packaging products with labels on them” is a transferable knowledge which can be appropriate for and applicable to various product types such as food containers, water bottles, and candle jars etc. In addition to that, the field observations conducted with people close to the researcher (students) are not helpful as the researcher knows mostly their opinions or responses in advance about a specific topic (in that case the post-use of glass packaging).

During the field observations, there were some product examples about re-use of glass packaging which the students found inspirational. The examples include photo albums or displays, moneyboxes, candle jars painted by the users, sewing boxes, toothbrush holders and olive oil feeders, which are able to fit bottles with various opening radii.



As for some of the findings from the field observations, the users have a tendency to re-use or re-value the glass packaging products in their homes (e.g. re-use of glass jars as jam jars on the breakfast table). They particularly keep and re-use glass packaging products which they find aesthetically pleasing. Furthermore, users tend (or are likely) to personalize and modify the products that they eager to re-use. They may admire the products that they make themselves, since these products have memories belonging to them. Another important finding from the field observations is that users do not prefer to use products labels of which are hard to remove particularly when they use the glass packaging products as decorative objects such as candle jars. Finally, the users' opinions about glass water bottles are not positive because without additional accessories (e.g. covers/sleeves) they can be easily dropped and broken.

#### **5.4.2 Idea generation process**

##### **Matrix exercise**

Matrix exercise appears to be useful in many ways. For instance, the matrix exercise has helped students to generate ideas for use and post-use phases of the products within a wider perspective. Also, this exercise has helped the students develop ideas within a short time; that is, the students save time through this exercise when developing ideas. The students are able to focus on a specific issue leading to the generation of detailed design ideas. Furthermore, many students developed the ideas generated during the matrix exercise further for the final design. On the other hand, in some situations ideas can not fit well into the specific cells in the matrix exercise (e.g. theme: 'super lid' and dimension: 'evolving'). In such cases some of the ideas are abandoned and replaced by new ones. To overcome this problem, the themes and dimensions given by the tutors can be more flexible implying that students can create and incorporate any dimension or theme as they find relevant to the project context.

The central focus of the matrix exercise is the themes and the dimensions given to the students. The themes and the dimensions are also found useful in many ways. Firstly, they serve as initial steps for developing ideas for both use and post-use phases. Secondly, they help students to generate and develop ideas through considering different aspects of the product (i.e. glass packaging). For instance, unless there is a theme called 'super lid' a student may not focus on the lid of the product which has a great significance for the use and post-use phases. Another benefit of the themes and dimensions is that they help the students to focus on a specific issue such as product accessories. Therefore, they appear to be useful in generating ideas for the use and the post-use phases of products. One possible reason for this is that students believe

that developing ideas for the use phase in accordance with the post-use phase is much easier with the help of them.

There are mainly three idea generation strategies that the students have followed during the exercise. The ideas can be developed through considering the post-use phase first and then trying to develop ideas for use phase in accordance with post-use and vice versa. Another way to develop ideas is to start from the idea that comes up first.

- Almost half of the students (n: 11) prefer to consider the post-use phase first
- A few students (n: 3) prefer to consider use phase first.
- Several students (n: 7) start developing ideas that they come up with first.

One possible reason for this, as students indicated, is that it was much easier to consider the post-use phase first and then consider the use phase accordingly. In addition to that, the specific themes related to post-use phase (such as my sweet glass hugger) might guide the students to generate ideas through considering the post-use phase first.

### **Task exercise**

It appears that the task exercise is useful, since new ideas can be generated throughout this exercise, and the ideas generated in the matrix exercise can be developed further. For example, the ideas can be developed further through considering the user group of the product (e.g. glass packaging between 3-6 years-old kids). In other words, issues related to defining and deciding the user group occur during the task exercise. However, in some situations the tasks given appear not to be suitable for the idea generated for post-use. For instance, if the user group determined by the student is different from the ones given in the task exercise, that user group related task would not make much contribution to the idea generation phase. Therefore, a flexibility of the tasks incorporated in the task exercise might be offered to the students.

### **Scenario building exercise**

According to majority of the students, the scenario building exercise can have little or no effect on the product idea. The main reason for this is that usually the product scenarios are likely to be considered when the initial ideas are generated. Therefore, during the exercise, only the illustrations of these scenarios can be made. On the other hand, this exercise is found useful to some extent. For instance, during this exercise the potential problems occurred during the use phase can be determined. Also new ideas can be generated during the exercise such as designing a honey jar lid which can be used for serving the honey in the breakfast table.

### 5.4.3 Final product idea

#### Design considerations

The literature and field observations made prior to the idea generations phase, and the user research conducted during concept development phase provide the students with design considerations related to water bottles and candle jar. The design considerations for the water bottles and candle jars based on the product ideas developed by the students include as follows:

##### *Design considerations for water bottles:*

- The lids should resist being thrown away or lost.
- The lids also should be durable enough to resist excessive use.
- The water bottle should be resistant to breakage because it is made of glass.
- The accessories should be cost-effective (i.e. they should not increase the overall cost and the prices of the product).
- The fabric covers should be designed so that the water bottle can give feedback about how much beverage remains inside the bottle.
- Fabric covers should be made of insulating materials so that the temperature of the beverage does not change rapidly.
- The labels should be easy to remove or other places (e.g. lid) should be used for labels instead of glass surface as users do not want to use products labels of which hard to remove.

##### *Design considerations for candle jars:*

- During the post-use there should be an opening for air circulation in order to allow the candle to burn.
- The product accessories should be decorative (e.g. various cut-outs on it), since the candle jar is a decorative object. Decorative accessories candle jar can create various light and shadow effects.
- Similar to the product accessories, the form of the glass (e.g. gravures on the glass) can be used to create such light and shadow effects.
- The lids have a great importance for the post-use phase; they can be used for decorative purposes like creating attractive environments as much as functional purposes like placing the label.

- The labels should be easy to remove or other places (e.g. lid) should be used for labels instead of glass surface, since users do not want to use products labels of which hard to remove.

### **Propose scenarios and product accessories**

The scenarios proposed for the post-use phase can vary but there are mainly three of them. The first one includes selling the product with its accessories for post-use. In this scenario accessories are given to the users as promotional products when they buy several products at the same time. This scenario may encourage users to purchase products with post-use phase (i.e. products with double life). The second scenario is selling the product and accessories separately. The main reason to offer such a scenario is that users may not want to pay for the accessories and they may not want to use the product for post-use. The third one is that users may use the products for post-use after bringing the product to a small-scale manufacturer to make changes on the product (e.g. flock coating). This scenario is offered for the situations where there is an alteration on the product which users are not capable of doing it (e.g. surface treatment applications like coatings).

The interviews conducted with the manufacturer indicate that all of these scenarios can be applicable, however selling the product accessories along with the product seems to be the most feasible solution, since it may decrease the overall cost of the product for the manufacturer and overall price for the user.

As for the product accessories, for the water bottles the most popular accessory is fabric cover or sleeve. The fabric covers/sleeves can be useful in many ways such as thermal insulation, impact resistance etc. For the candle jars, the lids themselves can serve as accessories. The cut outs on the lids can create appealing environments (e.g. light and shadow effects as mentioned before) for the users. In addition to that, stickers allowing users to personalize their products, which may lead user to re-value their products, are included in few design ideas. Lastly, besides fabric covers accessories made out of alternative materials (plastic and metal) are offered for the post-use phases.

Product's reference to use phases can be achieved through the form of the product (e.g. coffee mug shape water bottle) or keeping the label on the product. The reference to the use phase is sometimes maintained so that the product can convey the information that "this product has been used something else before" to the users. On the other hand product's reference to use phase can be eliminated through removing the labels. The removal of the labels is offered,

since users may want to use 'new' products and also they do not want to use the products which have still labels on their surface. This implies that post-use phase may create added value to the products when the resulting product (post-use) is regarded as new, which may encourage users to purchase the product.

In this chapter, the results of the primary research have been presented within two parts. The first part includes the project outcomes (i.e. design solutions for use and post-use developed by the students). The second part includes the results of the semi-structured interviews conducted with ID students and the manufacturer. Finally, overall conclusions for the primary study have been revealed (see Appendix J for overall summary). In the following chapter the conclusions for the research will be presented through revisiting the research questions. The chapter will conclude with the implications for design research process and further research.

## CHAPTER 6

### CONCLUSIONS

This chapter presents the conclusions of the research through revisiting the research questions addressed through the preliminary study and the primary research. The presentation of conclusions is followed by the concluding remarks. The chapter concludes with the implications of the study for design research process and further research.

#### 6.1 Research questions revisited

***What would be the implications of the integration of the ‘post-use design thinking’ into the early stages of the design process (i.e. idea generation phase)?***

The preliminary study results indicate that the post-use design thinking should be considered at the early stages of design process, otherwise attempts to develop post-use ideas for products which are nearly finished and detailed would not lead to well-developed post-use solutions. In other words, when the post-use aspects of the products are considered in the idea generation phase, both use and post-use phases would be more likely integrated into one single product. Furthermore, the primary research reveals that the matrix exercise contributes to the integration of post-use design thinking into the idea generation phase. The matrix exercise, where ideas developed for use and post-use phase concurrently at the initial phases of idea generation, seem to be helpful. This also supports the notion that the post-use design thinking should be considered at or be integrated into the early stages of idea generation phase.

From designer’s viewpoint, the post-use design thinking requires designing and developing two product solutions concurrently for the product use and post-use phases. This may lead to some difficulties and challenges during the design process. For instance, the students have some difficulties in generating ideas for the post-use aspect throughout the design process (particularly for Project 1). However, the difficulties can be minimized through literature searches and field observations which provide creative ideas related to post-use, and inspirational keywords determined specifically for post-use (e.g. themes and dimensions in the

Project 2). The outcomes of the Project 2 and the interview results support this argument, since only a few students indicated that they had difficulties in generating ideas for post-use.

***How would the specific idea generation strategies developed for the design projects (i.e. idea generation exercises) help students to generate ideas for the post-use phase?***

Throughout the project 2, students performed idea generation exercises including the matrix, task and scenario building exercises. The matrix exercise consists of specific themes and dimensions determined specifically for the use and post-use phases of the products. The task exercise includes various tasks related to specific user groups and use environment. The scenario building exercise includes two potential scenarios for two design ideas concerning questions such as how the product would be presented to user, or how the product would be presented.

The results of the primary research indicate that the matrix exercise seem to be useful in many ways. Firstly, this exercise is helpful in generating ideas for post-use. To be more specific, the themes and dimensions given to the students during the exercise help students to develop ideas for post-use through considering various aspects of the products such as lid, surface applications, and product accessories. In addition to that, they become initial steps for the idea generation, although several students have some difficulties in generating ideas. On the other hand, in some situations ideas developed during the exercise seem to be abandoned by the students because these ideas are not suitable for any matrix cell (i.e. themes and dimensions). As a suggestion, to overcome this problem, a more flexibility in themes and dimensions is required for this exercise; that is, student can add additional ones associated with the idea that they develop.

The task exercise seems to be useful in some cases, especially when the idea generated in the matrix exercise is well suited to the tasks given. For instance, the idea of designing a water bottle for children can be improved further during the task exercise with related task e.g. 'make the product specialized for 3-6 children'. However, when the idea is not associated with the tasks given, the task exercise appears to be not useful. For example, if the target group for the design solution is not the children, this task will make little or no contribution to this particular idea.

As for the scenario building exercise, it seems that this exercise makes little contribution to idea generation, or has a little effect on the product idea. The main reason for this is that the scenario building exercise is performed after the task exercise; that is, at the later stages of the

idea generation. Till scenario building exercise, most of the product ideas are nearly finished and detailed, the scenarios offered for the product ideas have been already considered before the exercise. It would be better to re-consider the sequence of the exercises; scenario building exercise can be repositioned at the early stages of idea generation in order to increase its potential contributions to the idea generation phase. Although the exercise seems to make little contribution at all, several students reveal that during the exercise new ideas could be generated related to the product idea.

In conclusion, it seems that the contribution of the exercises to idea generation depends on the product idea and the structure of the exercise. That is to say, when an idea is related to themes and dimensions in the matrix exercise, or to the tasks given in the task exercise, the exercises are helpful. Although it is hard to generalize the conclusions, we might say that among the idea generation exercises, the matrix exercise (including particularly themes and dimensions) is the most useful one for the Project 2. On the other hand, the scenario building exercise seem to be not useful, since it occurs at the later stages of the idea generation phase. Therefore, it might be required that the sequence of the exercises or their positions related to each other can be reconsidered.

***What would be the design considerations for use and post-use phases of the products analyzed throughout the study (i.e. water bottles and candle jars)?***

The field observations and the literature search conducted prior to the idea generation phase contribute to the development of design considerations for the water bottles and candle jars. The analysis of product solutions for use and post-use phases of water bottles and candle jars has revealed several design considerations related to specific product categories.

For the water bottles, one major problem seems to be the notion that due to its fragility water bottles can be broken easily. To prevent glass bottles from being broken, various product accessories such as fabric covers/sleeves can be used. These covers/sleeves can also provide thermal insulation in order to maintain the temperature of the beverage inside the bottle. Another important issue to be considered is the lid of the product. Since the product is used repeatedly, the lids of the products should be protected being thrown away or lost, should be durable enough to resist excessive use. Design details bringing together the fabric covers with the lids can be an effective solution to overcome this problem. Another important aspect is the label of the product; that is, the label of the product should be easy to remove, since users do not want to use products labels of which are hard to remove particularly when they use the product as a decorative object (e.g. candle jar). In doing so, the label of the product can be



placed onto the lid instead of on the glass surface. Finally, the product accessories should be cost effective; meaning that they should not increase the overall cost of the product, since it may discourage the user from purchasing the product.

For the candle jars the most prominent design consideration seem to be designing decorative candle jars creating appealing environments for the user. This can be achieved by offering additional accessories, surface applications, and changing the lid (e.g. cut-outs on the lid). Surface applications such as gravures on the glass are appropriate solutions for post-use, since they do not require additional costs for the company and also for the users. Particularly, when several jars placed next to each other, gravures on the glass jars can create light and shadow effects. In addition to that, lids of the products have a great importance for the post-use phase; they can be used for decorative purposes like creating appealing environments as much as functional purposes like placing the label. Similar to water bottles, offering labels which are easy to remove are required for the candle jars.

In conclusion, design considerations mentioned above seem to be related to post-use such as easy to remove labels, fabric covers compensating the fragility of the glass, creation of appealing environments and so on. On the other hand, offering additional accessories with minimum increase in the overall cost of the product seem to be related to both the use and post-use phases of the products.

***What would be the potential use and post-use solutions for these products (i.e. water bottles and candle jars)?***

The use and post-use solutions for water bottles include offering product accessories such as fabric covers. The accessories can have various functions. They can prevent the bottle being broken, they can provide thermal insulation, and they can make users to grip the bottles easily. When they are attached to lids, they can prevent the lids being lost. The design solutions for post-use are mainly related to functional requirements of the water bottles.

The use and post-use solutions for the candle jars include offering 2D surface applications such as serigraphic prints and stickers, and revaluing the lids as decorative parts, offering surface applications such as gravures. Product solutions for post-use are mainly related to decorative aspects (or aesthetic requirements) of candle jars.

The design considerations such as offering easy to remove labels, fabric covers for preventing breakage, and decreasing the cost and price of the products so that users purchase them imply

that the use and post-use solutions seem to focus on users. This might stem from the literature search and the field observations conducted prior to the idea generation because these considerations are determined considering the results of them. Furthermore, scenarios offered for post-use focus on decreasing the cost of the product through offering promotional packages containing products and their accessories. This implies that proposed scenarios concern manufacturer in terms of their feasibility, and also concerns the users in terms of encouraging them to purchase the products.

***From designers' and manufacturers' viewpoint is 'post-use design thinking' possible/feasible?***

The interviewees from manufacturer (chief mould design manager and industrial designer) have positive attitudes towards the post-use design thinking. This thinking has been found feasible in terms of theory and practice. Although it has not finalized yet, the manufacturer company is dealing with issues similar to the post-use design thinking, which implies that the post-use this thinking is applicable to glass packaging products. However, it should be noted that user behavior can play a significant role in terms of post-use design thinking; that is, users make the last choices to purchase or not a particular product. Therefore, the consideration of user behaviors has great importance in terms of evaluating the applicability of this design thinking, since companies need economic viability to maintain their business.

There are mainly three proposed scenarios for the products: selling the product along with the product in a promotional package, selling the product accessory separately in various stores and bringing the product to a small scale manufacturer for post-use. Among these strategies, the first one (i.e. selling the product with promotional package) seems to be the most feasible as this scenario would not require additional costs for manufacturers and users.

## **6.2 Implication of this research for improving the idea generation exercises**

To conclude, post-use design thinking is a promising approach to address sustainable consumption and production through achieving product longevity. The study shows that this design thinking can be applicable in terms of theory and practice particularly within the type of glass packaging industry. Considering that the recycling rate of the glass is relatively low in Turkey, this design thinking can provide valuable opportunities to decrease the environmental impacts related to glass packaging products.

The idea generation strategies (or exercises) appear to be useful in terms of developing ideas for the post-use design thinking in the glass packaging. Among these exercises, the matrix exercise where the ideas for use and post-use phases developed concurrently through using specific themes and dimensions. However, other themes and dimensions offered by the students should be allowed to be added within the matrix cells, in order to enable more diverse design solutions for use and post-use. The matrix table should be designed in a way that the students can tailor it to their preferences on project themes and dimensions.

Once the ideas developed, these can be improved further through task exercise. The major issue with the task exercise is that in some situations the tasks given for the exercise are not related to the design solutions developed in the matrix exercise. When the specific tasks are designed through these ideas evolved from the matrix exercise, the task exercise would be more likely to make effective contributions to the idea generation and development process.

As for the scenario building exercise, this exercise does not make significant contributions to the design solutions, since the scenarios are developed at the early stages of idea generation phase. The underlying reasons for that might be the predetermined product categories for post-use (i.e. water bottles and candle jars) prior to the idea generation process. This implies that, if the product categories for post-use are not determined before the idea generation phase, new scenarios for post-use (e.g. designing jars which can be used as money boxes) can be developed or offered during this exercise. In such a case, the order of the exercise should be reconsidered implying that scenario building exercise could be carried out at the early stages of idea generation phase. For instance, this exercise either can be integrated into the matrix exercise or carried out before the matrix exercise. After gathering the results from field observations, diverse scenarios for post-use can be generated through brainstorm sessions. During the matrix exercise design solutions for use and post-use can be developed in accordance with the scenarios proposed earlier in the design process. These design solutions can be improved further via specific tasks related to these specific solutions.

In short, the matrix exercise seems to be an effective tool for developing ideas for post-use design thinking, whereas the other exercises (task and scenario building exercise) should be revised so that they can make significant contributions to the ideas or design solutions developed in the matrix exercise. Furthermore, during these exercises new ideas can also be created. Therefore, the exercise should allow students to use new ideas different from the ones developed in previous exercises.

This thesis presents the conclusions from and insights into a graduate research. To explore the post-use design thinking, two industrial design projects were investigated through conducting interviews with the students and the manufacturer, and analyzing the project outcomes. This thesis does not aim to make generalizations about the product design process based on the conclusions drawn from the research. Instead it attempts to explore a relatively new approach within the opportunities of design research, process and education. Furthermore, the ideas and the conclusions presented here are inspirational instruments which can encourage various parties such as users, educators, students, designers and producers and so on to reconsider or rethink our production and consumption means in terms of sustainability.

### **6.3 Implications for research design process**

To explore the post-use design thinking, two educational industrial design projects were analyzed. There are some advantages of choosing an educational project as a case for the analysis. For instance, educational projects can be experimental, implying that the variables and the boundaries of the projects can be controlled easily. However, analyzing educational industrial design projects and interviewing ID students may not be adequate to draw general or broad conclusions about the product design process. Nevertheless, the insights of the ID students are worth exploring, since they will be the future industrial designers. That is to say, when they become professional designers, they may be able to integrate the post-use design thinking into the product design process which can provide further opportunities for investigating the approach in terms of design practice.

### **6.4 Implications for further research**

This thesis addresses three areas of further research related to the post-use design thinking. Firstly, although this design thinking seems to be applicable for glass packaging products, the implications of this design thinking for other product categories such as home electronics and furniture are worth investigating. Moreover, the implications of this design thinking for design practice should be explored further to provide insights into the integration of this thinking into the design process. Secondly, the users response towards the products designed through the post-use design thinking seem to be valuable for further research. To achieve sustainable consumption users have a significant role. Although a product has greater efficiency in terms of energy use and product life spans, environmental benefits can be offset through user behavior (i.e. users may have a tendency to use the product in a way that increases energy consumption

or they may even not want to use the product). Hence, the questions such as *how users would respond to the products designed using post-use design thinking*, should be answered in order to improve this approach further. Finally, this thinking embraces user involvement in the design process. Yet, this study does not encompass the implications of the user involvement for sustainable consumption and production. Therefore, this can be explored to provide insights into issues such as *how user involvement would effect or influence consumption patterns of the users, and how user involvement would influence product life spans*.

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## APPENDIX A

### PRELIMINARY STUDY - INTERVIEW QUESTIONS FOR STUDENTS (IN TURKISH)

1. Proje geliştirme sürecinizi düşündüğünüzde; sonraki kullanım kavramını hangi aşamada (ne zaman) düşünmeye başladınız?
2. Proje geliştirme sürecinizi düşündüğünüzde; sonraki kullanım kavramını tasarladığınız ürüne nasıl yansıttığınız düşünüyorsunuz? Bunu örneklerle açıklayabilir misiniz?
3. Ürünün sonraki kullanım boyutunu düşünürken ne gibi zorluklarla karşılaştınız? Eğer karşılaştıysanız bunu örnekler vererek açıklar mısınız?
4. Proje kapsamında yaptığınız egzersizin, ürünün sonraki kullanım boyutunu düşünmenizde ne gibi etkileri oldu?

## APPENDIX B (a)

### PRIMARY RESEARCH - INTERVIEW QUESTIONS FOR MANUFACTURER (IN TURKISH)

Questions for chief mould design manager (Tamer Öztürk)	Questions for industrial designer (Oya Akman)
<ol style="list-style-type: none"><li>1. Firma olarak sürdürülebilirlik kavramına nasıl yaklaşıyorsunuz? Bu konuda hayata geçirdiğiniz projeleriniz var mı?</li><li>2. Cam ambalajların piyasadan geri toplanması konusundaki görüşleriniz nedir? Firmanız bu konuda nasıl bir strateji izliyor?</li><li>3. Bir ürünün sonraki kullanımının da dikkate alınarak tasarlanması düşüncesine yaklaşımınız nedir? Bu tarz bir düşünceyi destekliyor musunuz?</li><li>4. Çifte ömürlü bir ürünün tasarlanması ve üretilmesinin firmanız açısından avantajları ve dezavantajları ne olabilir?</li><li>5. Proje kapsamında yapılan öğrenci projelerinden ilginizi çekenler var mı? Bunlar hangi yönlerden ilginizi çekti, bizimle paylaşabilir misiniz?</li><li>6. Öğrencilerin önerdiği ürünü dönüştürme senaryolarından (kullanıcı, üretici ve tedarikçi, yerel üretici) sizce hangileri uygulanabilir?</li></ol>	<ol style="list-style-type: none"><li>1. Bir endüstri ürünleri tasarımcısı olarak sürdürülebilirlik kavramına nasıl yaklaşıyorsunuz? Bu konuda hayata geçirdiğiniz projeleriniz var mı?</li><li>2. Bir ürünün sonraki kullanımının da dikkate alınarak tasarlanması düşüncesine yaklaşımınız nedir? Bu tarz bir düşünceyi destekliyor musunuz?</li><li>3. Bir ürünü sonraki kullanımını ile beraber tasarım sürecinin en başından itibaren düşünerek tasarlamak tasarım sürecinizi nasıl etkileyebilir?</li><li>4. Öğrencilerin önerdiği ürünü dönüştürme senaryolarından (kullanıcı, üretici ve tedarikçi, yerel üretici) sizce hangileri uygulanabilir?</li></ol>

## APPENDIX B (b)

### PRIMARY RESEARCH – INTERVIEW QUESTIONS FOR MANUFACTURER (IN ENGLISH)

Questions for chief mould design manager (Tamer Öztürk)	Questions for industrial designer (Oya Akman)
<ol style="list-style-type: none"> <li>1. How would you approach the notion of sustainability as a company? Is there any project that your company carries out related to sustainability? If yes, could you explain them?</li> <li>2. What would you think about recollection or recovery of glass packaging products? Could you explain the strategies that your company follows for recovering the glass?</li> <li>3. What is your opinion about post-use design thinking? Would you support such design thinking?</li> <li>4. What would be the advantages and disadvantages of designing double life products for your company?</li> <li>5. Is there any product idea that you found interesting among the ideas developed by the students? Could you explain for which aspects you found these products interesting?</li> <li>6. According to you, which of the scenarios offered by the students are feasible or applicable?</li> </ol>	<ol style="list-style-type: none"> <li>1. How would you approach the notion of sustainability as an industrial designer? Is there any specific project that you manage related to sustainability?</li> <li>2. What is your opinion about post-use design thinking? Would you support such design thinking?</li> <li>3. What would be the implications of the integration of post-use design thinking at the early stages of design process for your product design process?</li> <li>4. According to you, which of the scenarios offered by the students are feasible or applicable?</li> </ol>

## APPENDIX C

### PRIMARY RESEARCH - INTERVIEW QUESTIONS FOR STUDENTS (IN TURKISH)

1. Yaptığınız gözlem ve literatür araştırması sonuçlarından projeniz nasıl etkilendi?
2. *Matrix* egzersizi fikir geliştirme sürecinizi nasıl etkiledi?
3. Egzersiz boyunca aynı anda bir ürünün iki kullanımını düşünerek fikir geliştirdiniz. Bu süreci bizimle paylaşabilir misiniz? Birbirinden çok farklı veya çeşitli fikirler geliştirebildiniz mi?
4. *Matrix* egzersizinde cam ambalajın kapak, yüzey işlemleri, etiket ve zarf gibi kısımlarını ayrı ayrı proje boyutlarıyla beraber düşünmek fikir geliştirme sürecinizi nasıl etkiledi?
5. Seçtiğiniz cam ambalajın ( kavanoz veya şişe ) , sonraki kullanımı için önerdiğiniz kullanım kontekstini / bağlamını ( mumluk veya matara) seçerken nelere dikkat ettiniz/ neleri göz önünde bulundurdunuz? *Matrix* egzersizini yapmadan önce bunu belirlemiş miydiniz?
6. Tasarladığınız cam ambalajların sonraki kullanım alanlarının önceden belirlenmiş (önerilen) ürünler olması ( mumluk ve matara) fikir geliştirme sürecinizi nasıl etkiledi?
7. *Task* egzersizi fikir geliştirme sürecinizi nasıl etkiledi?
8. Senaryo geliştirme egzersizi fikir geliştirme sürecinizi nasıl etkiledi?
9. Son ürüne baktığımızda; tasarım sürecinizi düşünürsek birincil kullanım ve ikincil kullanım aşamaları birbirilerini nasıl etkiledi?
10. Son ürünü düşündüğümüzde birincil kullanım ve ikincil kullanım aşamalarından ön plana çıkan var mı? Var ise sizce neden?
11. Cam ambalaj mumluk veya mataraya dönüştürülürken üründe ne gibi değişiklikler önerdiniz? Önerdiğiniz değişiklikler nasıl gerçekleştiriliyor? Bu değişiklikleri yapma sebeplerinizi açıklayabilir misiniz? ( Ör. Camın formu, kapak, yüzey işlemleri, kılıf)
12. Sonraki kullanım için önerdiğiniz fikirlerde kişiselleştirmeye yönelik çözümleriniz var mı? Bunu (kişiselleştirme) tercih etme sebepleriniz nelerdir?
13. Mumluk veya matara olması önerilen cam ambalajın ilk kullanımını hatırlatması veya ona referans vermesini istediniz mi? İstediyse bu yapabilmek için ne gibi öneriler getirdiniz? Eğer istemediyse bu önlemek için ne gibi öneriler getirdiniz?
14. Ürünün marketteki diğer ürünlerden farklı olarak çift ömürlü bir ürün olduğu ve yeni bir ürüne (mumluk veya matara) dönüşebildiği ve bu dönüşüm nasıl olacağı konusunda kullanıcıyı bildirmek amacıyla ne gibi öneriler getirdiniz? Neden bunları tercih ettiniz?

## APPENDIX D

### INDUSTRIAL DESIGN PROJECT 1 BRIEF

METU Department of Industrial Design  
Fall 2009-2010 ID 301 Industrial Design III

Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Demet Eryürek, Part-time Inst. Dr. Çağla Doğan,  
Res. Asst. Aykut Coşkun, Res. Asst. Senem Tural

28 September 2009

#### **Project I – Sustainable solutions for kids: creating a space of their own**

##### **Project teaching goals:**

- product – user interaction (e.g. participation, interaction, gender, privacy and space)
- modelling and research skills (e.g. developing full-scale models, and incorporating user participation and testing)
- sustainability (i.e. personalization/product customization, affordability, environmentally conscious solutions and materials)

##### **Project brief:**

Kids are inclined to generate a space of their own through engaging in creative activities and imaginative play. The aim of this project is to develop design solutions for preschool kids between 3 and 6 years-old, which

- embody their privacy and space needs
- help kids co-create a space of their own, and foster creativity, participation and interaction
- help kids improve their motor and social skills
- promote affordable and accessible alternatives to mainstream solutions
- contribute to sustainable and healthy environments

**Materials:** You are allowed to use paper-based materials and/or fabrics only as the primary materials. In addition to these, various accessories and/or adhesives may be incorporated into the design.

##### **Part 1 Design Research (group presentation: October 9<sup>th</sup>):**

- literature review: exploration of research topics attached
- user observation: observations and recordings at daycares (within lower, medium and higher income range, public and private) and private homes

##### **Part 2 Idea Generation (group presentation: October 16<sup>th</sup>):**



- sketching, mood board and brainstorming sessions and exercises

**Part 3 Preliminary Jury - Idea Book, User Testing and Budget Estimation (individual presentation: October 26<sup>th</sup> & 28<sup>th</sup>)**

- reflection and further product/concept development
- user participation and testing (working models will be tested for the development and refinement of design solutions)

**Part 4 Final Design**

- final presentation including all project deliverables

**Part 5 Post Project Phase (optional): reaching out kids with our projects**

- making project outcomes available and accessible to potential user groups (daycares, pediatric departments at hospitals or medical centers, families in need, use sessions at playgrounds or your neighbor downstairs)

Project outcome will be evaluated based on the criteria attached to the design brief.

Project deliverables due date: November 16<sup>th</sup>, 9:00-12:00

Final jury: November 16<sup>th</sup>&18<sup>th</sup>

## APPENDIX E

### TASK EXERCISE FOR PROJECT 1

Fall 2009-2010 ID 301 Industrial Design III

Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Demet Eryürek, Part-time Inst. Dr. Çağla Doğan,  
Res. Asst. Aykut Coşkun, Res. Asst. Senem Tural

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23 October 2009

#### Project I – Sustainable Solutions for Kids: Creating a Space of Their Own

#### Idea Generation IV: Tasks

##### Aim

Today's exercise will be conducted to develop and enrich the ideas in your matrix based on the tasks given. Each group member will contribute to developing ideas by performing the four tasks described below in turns.

##### Tasks

1. Make it a gendered product (i.e. for girls or boys) OR switch the gender.
2. Make the product affordable/accessible for low income families.
3. Make it a fun experience for parents/care givers as well.
4. Turn the product or one of its components into a record of one's childhood.

##### Procedure

1. Start with the ideas in the cells marked in the matrix below. Take as many ideas as the number of people in your group (i.e. groups with four members-four ideas, groups with five members-five ideas).

##### Ideas to be worked on

	Dimension I	Dimension II	Dimension III	Dimension IV	Dimension V
super ground	<b>idea1</b>				
magical door		<b>idea2</b>			
my dear monster friends (MMF)			<b>idea3</b>		<b>idea5</b>
fun zone				<b>idea4</b>	

2. Each group member will develop the idea in front of him/her based on the first task for 15 minutes. When the time is over, pass the sheet on to the person on your right. Develop the idea

in front of you based on the second task, and so on. Carry out this process until all the four tasks are completed. Give 15 minutes to each task.

**Task sessions**

**First task (15 minutes)**

- Group member1-idea1-task1
- Group member2-idea2-task1
- Group member3-idea3-task1
- Group member4-idea4-task1
- Group member5-idea5-task1

**Second task (15 minutes)**

- Group member1-idea2-task2
- Group member2-idea3-task2
- Group member3-idea4-task2
- Group member4-idea5-task2
- Group member5-idea1-task2

And so on....

**Format**

Use the exemplary format given below.  
 A3 size white paper  
 Orientation: Landscape

Idea 2: magical door-interactive			
Task 1	Name and Surname	Task 2	Name and Surname
Task 3	Name and Surname	Task 4	Name and Surname

## APPENDIX F

### INDUSTRIAL DESIGN PROJECT 2 BRIEF

METU Department of Industrial Design  
Spring 2009-2010 ID 302 Industrial Design IV

Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Dr. Çağla Doğan, Part-time Inst. Demet Eryürek,  
Res. Asst. Aykut Coşkun, Res. Asst. Erçin Okursoy

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Project I: Transcending Products

Sustainable alternatives for glass packaging with a special emphasis on post-use phase

**Project teaching goals:**

- Sustainable product design and social responsibility—bringing together mass-production with local production, large scale with small scale and global values with local values
- Integrating **post-use design thinking** into the early stages of design process
- Systems thinking –analysing and **rethinking the whole product lifespan**
- Glass packaging design reconsidered

**Keywords:** sustainable, inclusive, natural, diverse, reflective, holistic, incremental, evolving, adaptable, transformable, healthy, renewable, local.

Designers can redefine our notion of design and consumption through providing innovative solutions and insights into the societal and environmental aspects of the whole product lifespan (i.e. design, material selection, production, product use, and post-use). This is particularly the case for food consumption with its ever increasing waste (e.g. disposable coffee cups, Styrofoam breakfast trays and related packaging).

This project will be undertaken in collaboration with Anadolu Cam, the major glass packaging producer in Turkey. The aim of this project is to develop design solutions and relationships, which demonstrate the potential of **post-use** (i.e. **rethink, reuse and recycle/up-cycle** for product design) in the area of glass packaging for food and beverages.

The project will focus on both the **use** and the **post-use** phases of the product lifespan. The emphasis is on transforming mass-produced glass packaging designs (mainly jar and bottle designs) into promotional products incorporating locally produced materials, parts or finishes. The promotional products should reflect Anadolu Cam's corporate vision of sustainability (i.e. social responsibility, environmental stewardship, and economic viability).

The glass packaging designs will be developed for the following product categories:

- Honey, jam, chocolate and nut spread
- Dry food (instant coffee, milk powder, spices, etc.)
- Conserved food and appetizers
- Yoghurt
- Milk

- Edible oil, vinegar
- Wine, spirits, beer
- Soft drinks and beverages, sport drinks
- Water, mineral water

Once the glass packaging –mainly jars and bottles– fulfills its initial lifespan, it will be re-contextualized and transformed into one of the following promotional products:

- Candle jars
- Water bottles

### **The stages of the project:**

#### **Part 1 – Literature Search, Field Observations and Project Dimensions (1 week)**

Conduct literature search on assigned topics and make user observations at private homes and retail stores. Based on the major conclusions you reached, provide project dimensions.

**Output:** 15 minutes presentation supported by A3 presentation boards.

#### **Part 2 – Initial Design Exploration (1 week)**

Work on project dimensions through the mood board exercise. Develop initial ideas through the matrix exercise to explore diverse design solutions.

**Output:** Mood boards and diverse design ideas for glass packaging and promotional products.

#### **Part 3 – Concept Development and User Testing (2 weeks)**

Further explore the initial design ideas through the task and scenario building exercises. In order to assess the potential of use and post-use design solutions, conduct interviews with potential users.

**Output:** Alternative design solutions, product lifespan scenario, appearance model, and user testing results.

#### **Part 4 – Final design (3 weeks)**

Present the final design solution with a real size rapid-prototyped model.

## APPENDIX G

### INDUSTRIAL DESIGN PROJECT 2 CALENDAR

ODTÜ ENDÜSTRİ ÜRÜNLERİ TASARIMI BÖLÜMÜ 2009-2010 BAHAR DÖNEMİ  
Anadolu Cam A.Ş. işbirliğiyle cam ambalaj eğitim projesi

ID 302 Endüstri Ürünleri Tasarımı IV\*

PAZARTESİ	SALI	ÇARŞAMBA	PERŞEMBE	CUMA	CUMARTESİ	PAZAR
Kayıtlar 15 Şubat	Kayıtlar 16 Şubat	Kayıtlar 17 Şubat	Dersler başlıyor. 18 Şubat	Anadolu Cam projesi başlıyor. 19 Şubat	20 Şubat	21 Şubat
Anadolu Cam'dan konuklar, sunuşlar 22 Şubat	23 Şubat	Çağla Doğan'ın Semineri 13:40-14:30 ve kritikler 24 Şubat	25 Şubat	Anadolu Cam fabrika gezisi 26 Şubat	27 Şubat	28 Şubat
Tasarım araştırması ve proje boyutları sunuşu 1 Mart	2 Mart	Moodboard teslimi Fikir geliştirme egzersizleri: Matriks I 3 Mart	4 Mart	Teslim: Matriks II Anadolu Cam kritikleri I 5 Mart	Dolum-etiketleme tesisi ziyareti 6 Mart	7 Mart
Fikir geliştirme egzersizleri: Task I 8 Mart	9 Mart	Teslim: Task II Fikir geliştirme egzersizleri: Senaryo Kurma I 10 Mart	11 Mart	Senaryo kurma II Kritikler 12 Mart	13 Mart	14 Mart
Ara jüri 08:40-17:30 15 Mart	16 Mart	Kullanıcı testi çalışmaları Kritikler 17 Mart	18 Mart	Kullanıcı testi çalışmaları Kritikler 19 Mart	20 Mart	21 Mart
Kullanıcı testi sunuşları 22 Mart	23 Mart	24 Mart	25 Mart	Ürün kesit ve detayları Kritikler 26 Mart	27 Mart	ortografik görünüşler, kesitler ve detaylar 24:00 (metuonline) 28 Mart
Anadolu Cam Kritikleri II Tamer Öztürk Oya Akman 29 Mart	30 Mart	Mustafa Hasdoğan Teknik çizim ve sunuş kritikleri 31 Mart	1 Nisan	Refik Toksöz Modelleme ve sunuş kritikleri 2 Nisan	3 Nisan	Pafta teslimi (Dijital) 24:00 (metuonline) 4 Nisan
Pafta teslimi (A3 çıktılar) 17:00 5 Nisan	Kontrol + Hızlı prototipleme I 6 Nisan	Kontrol + Hızlı prototipleme II 7 Nisan	Hızlı prototipleme III 8 Nisan	Proje kitapçığı için bireysel teslim Hızlı prototipleme IV 9 Nisan	10 Nisan	11 Nisan
Hızlı prototipleme V 12 Nisan	13 Nisan	Final jüri 08:40-17:30 14 Nisan	15 Nisan	Anadolu Cam final sunuşu ziyareti 16 Nisan	17 Nisan	18 Nisan

\* ID 302 tasarım stüdyosu dersleri, pazartesi, çarşamba ve cuma günleri 13:40-17:30 saatleri arasındadır.

## APPENDIX H (a)

### MATRIX EXERCISE FOR PROJECT 2

METU Department of Industrial Design  
Spring 2009-2010 ID 302 Industrial Design IV

Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Dr. Çağla Doğan, Part-time Inst. Demet Eryürek,  
Res. Asst. Aykut Coşkun, Res. Asst. Erçin Okursoy

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Project I: Transcending Products  
Sustainable alternatives for glass packaging with a special emphasis on post-use phase

#### Idea Generation: Matrix (Individual work)

**Digital submission** (only JPEG or PDF, real size 200 dpi): <https://online.metu.edu.tr/> 05 March 2010 Friday 12:00

Late digital submission: <https://online.metu.edu.tr/> 05 March 2010 Friday 24:00

**Presentation:** 05 March 2010 Friday 13:40

**Aim:** The aim of this exercise is to explore various dimensions of the project within the context of particular themes.

**Outline:** Prepare a matrix by placing the project dimensions on the top of each column, and the themes on the left of each row as described below. Sketch concept ideas inspired by the themes and the dimensions. Complete the matrix by placing the concept ideas in the relevant cells.

Matrix		Dimensions		
		Alternative Dimension I	Alternative Dimension II	Alternative Dimension III
		Transformable	Tactile	Locally-inspired
Theme	Super lid	x		
	Super natural makeup		x	
	My sweet glass hugger			x

Today you are expected to develop **three** ideas for the specific cells marked above with the following theme-dimension pairs:

- Super lid–Transformable
- Super natural makeup–Tactile
- My sweet glass hugger–Locally-inspired

After today's exercise, you are expected to develop **six** more ideas. For the remaining six ideas, you may either use the current dimensions suggested by us, or choose one, two or three alternative dimensions from the following groups. Please choose only one dimension from each group.

Alternative dimension group I: Honest, natural, joyful, healthy, pure, glowing, reflective

Alternative dimension group II: Enduring, improvised, complementary, regenerative, evolving, fertile

Alternative dimension group III: Informative, communicative, empowering, affordable

**Outcome:** By Friday you are expected to complete **nine** ideas in total.

**Format:** For each cell use A3 size paper, orientation: landscape. Use the format provided below.

Theme–Dimension	Name and Surname
Glass Packaging: <i>Yoghurt</i>	Post-use : Candle jar/Water bottle



## APPENDIX H (b)

### TASK EXERCISE FOR PROJECT 2

METU Department of Industrial Design  
Spring 2009-2010 ID 302 Industrial Design IV

Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Dr. Çağla Doğan, Part-time Inst. Demet Eryürek,  
Res. Asst. Aykut Coşkun, Res. Asst. Erçin Okursoy

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Project I: Transcending Products  
Sustainable alternatives for glass packaging with a special emphasis on post-use phase

#### **Idea Generation: Task** (Individual work)

**Digital submission** (only JPEG or PDF, real size 200 dpi): <https://online.metu.edu.tr/> 10 March 2010 Wednesday 12:00

Late digital submission: <https://online.metu.edu.tr/> 10 March 2010 Wednesday 24:00

**Presentation:** 10 March 2010 Friday 13:40

#### **Aim**

Today's exercise will be conducted to develop and enrich the ideas in your matrix based on the tasks given. You will develop ideas individually by performing the three tasks described below.

#### **Tasks**

5. Make it a family of products with alternative accessories OR a set of products with various sizes and surface finishing/labelling applications.
6. Make it personalized for preschool children between 3-6 years old OR for university students on campus.
7. Make it for travel use OR home/dormitory use.

#### **Procedure**

1. Compile two ideas from your matrix study for a promotional product category (candle jar or water bottle).
2. Apply all the three tasks to each idea (use one A3 for each task). Devote approximately 20 minutes to each task.

**Format**

Use the exemplary format given below. Paper: A3 size white paper. Orientation: Landscape.

Compiled Idea 1	Name and Surname
Glass Packaging: <i>Yoghurt</i>	Post-use: Candle jar/Water bottle

Task 1 (alternative accessories)	Name and Surname
Glass Packaging: <i>Yoghurt</i>	Post-use: Candle jar/Water bottle

## APPENDIX H (c)

### SCENARIO BUILDING EXERCISE FOR PROJECT 2

METU Department of Industrial Design  
Spring 2009-2010 ID 302 Industrial Design IV

Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Dr. Çağla Doğan, Part-time Inst. Demet Eryürek,  
Res. Asst. Aykut Coşkun, Res. Asst. Erçin Okursoy

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Project I: Transcending Products  
Sustainable alternatives for glass packaging with a special emphasis on post-use phase

#### Scenario Building

**Digital submission** (only JPEG or PDF, real size 200 dpi): <https://online.metu.edu.tr/> 12 March 2010 Friday 12:00

Late digital submission: <https://online.metu.edu.tr/> 12 March 2010 Friday 24:00

**Presentation:** 12 March 2010 Friday 13:40

In this exercise, you are required to compile two alternative design solutions from the ideas you developed in the matrix and task exercise, and to develop a detailed scenario for each design solution.

When developing your scenarios follow the steps described below:

1. Develop a full story which describes the glass packaging and the transformation of it into a promotional product (i.e. a candle jar or a water bottle).
2. Organize your story into as many stages as necessary.
3. Visualize each stage of your scenario, and support your frames with written descriptions.

You are free to use various visualization techniques such as sketching, collage or photography to communicate your scenarios. Please pay attention to the visual unity and quality of your work.

**Format:** Paper: A3, orientation: landscape

## APPENDIX I (a)

### CONSENT FORM FOR ID STUDENTS

#### CONSENT FORM

**Research Project Title:** The implications of post-use design thinking and personalization on design process

**Investigator:** Aykut Coşkun, M.Sc. student, Middle East Technical University

I am a M.Sc. student in the Department of Industrial Design and I am carrying out a study which aims to investigate the implications of personalization for design process, and to find out how post-use scenario thinking would be integrated into the early stages of design process. My research involves the analysis of the outcomes of the student projects (i.e. products and product ideas generated during the projects carried out for the courses Industrial Design 301 and 302 in the Department of Industrial Design) by considering post-use scenario thinking, and semi-structured interviews with industrial design students to provide insights on design process. The research results will provide a basis for the development of papers for journal publications and for the completion of my Master Thesis.

This consent form, a copy of which has been given to you, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, please feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

I wish to interview you because of your attendance and performance in the first project of the course Industrial Design IV. Your participation would involve answering questions in an interview, which is expected to take approximately 20-25 minutes. The interviews will be audio taped. Your participation is voluntary and you may withdraw from the study at any time, in which case your responses would not be used.

As the interview questions are related to your work performed during the project, I may request to observe visual representations of your ideas (i.e. sketches, renderings, 3D models, photographs etc.) during the interview. Your participation is voluntary and you may withdraw from the study at any time, in which case any visual representations would not be used.

For the interview and the observation, two options are provided below for the confidentiality agreement; please initial (one).

For the interview:

\_\_\_\_\_ My name may be used in the Master Thesis and journal publications in connection with the information I provide.

\_\_\_\_\_ I wish to remain anonymous. My name will not be used and the information that I give will not be connected to my identity in any way.

For the observation:

\_\_\_\_\_ The visual representations (i.e. sketches, renderings, 3D models, photographs) those do not reveal my identity may be used in the Master Thesis and journal publications.

\_\_\_\_\_ Visual representations (i.e. sketches, renderings, 3D models, photographs) will be kept confidential; they will not be published in any way.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time. If you have further questions concerning matters related to this research, please contact:

Aykut Coşkun, M.Sc. Student  
Department of Industrial Design,  
Faculty of Architecture  
Middle East Technical University  
Phone: 0 312 210 6223  
E mail: [aykutcoskuntasarim@gmail.com](mailto:aykutcoskuntasarim@gmail.com)  
[aycoskun@metu.edu.tr](mailto:aycoskun@metu.edu.tr)

Assist. Prof. Dr. Çağla Doğan, Supervisor  
Department of Industrial Design, Faculty of  
Architecture  
Middle East Technical University  
Phone: 0 312 210 2247  
E mail: [dcagla@metu.edu.tr](mailto:dcagla@metu.edu.tr)

Participant's signature  
Date

Investigator' signature  
Date

\*A copy of this consent form has been given to you to keep for your records and reference

## APPENDIX I (b)

### CONSENT FORM FOR MANUFACTURER

#### ARAŞTIRMA İZİN FORMU

**Araştırma Konusu:** 'Post-use' tasarım düşüncesinin tasarım sürecine ve ürün-kullanıcı ilişkilerine etkisi

**Araştırmacı:** Aykut Coşkun, Yük. Lis. öğrencisi, Orta Doğu Teknik Üniversitesi

ODTÜ Endüstri Ürünleri Tasarımı Bölümü (EUTB) yüksek lisans öğrencisiyim. Yüksek lisans süresince, 'post-use' tasarım düşüncesinin tasarım sürecine ve ürün kullanıcı ilişkilerine nasıl etki edeceğini inceleyen bir araştırma yapmaktayım. Araştırma kapsamında, ODTÜ EUTB 3.sınıf stüdyosunda 2010 bahar döneminde Anadolu Cam A.Ş işbirliği ile yürütülen endüstriyel tasarım projesi( çift ömürlü cam ambalaj projesi) incelenecektir. Bu araştırma, 3.sınıf EUTB öğrencilerinin ve Anadolu Cam A.Ş.'nin proje sürecine dair fikirlerinin alınmasını içermektedir. Araştırma sonucunda elde edilecek sonuçlar bilimsel makalelerin yayımlanması ve yüksek lisans tezimin tamamlanması açısından değerli olacaktır.

Bu araştırma izin formunun, yapılacak olan araştırma hakkında ve sizin bu araştırmaya katılımcı olarak nasıl yardımcı olacağınız hususunda size bilgi vermesi amaçlanmıştır. Burada bahsedilen veya burada yer almayan herhangi bir bilgi hakkında daha detaylı sorularınız olursa lütfen sormaktan çekinmeyin. Sizinle röportaj yapmak istememin sebebi, yukarıda bahsi geçen endüstriyel tasarım projesine vermiş olduğunuz her türlü destek ve cam ambalaj konusunda (özellikle çevre ve cam konusunda) hatırı sayılır bir tecrübeye sahip olmanızdır. Katılımınız daha önceden belirlenmiş birtakım röportaj sorularını cevaplamak şeklinde olacaktır ve bu röportaj yaklaşık 15–20 dakika sürecektir. Röportaj ses kayıt cihazı ile kayıt edilecektir. Röportaja katılımınız gönüllü olduğundan, dilerseniz araştırmaya katılmaktan vazgeçebilirsiniz. Bu durumda cevaplarınız hiçbir şekilde kullanılmayacaktır.

Yapılacak röportaj için; katılımcı bilgilerinin gizliliğine dair seçenekler aşağıda verilmiştir. (Lütfen bir tanesini seçiniz)

\_\_\_\_\_Verdiğim bilgilerle bağlantılı olmak koşulu ile; yüksek lisans tezinde veya yayımlanacak bilimsel makalelerde adımın geçmesinde bir sakınca yoktur.

\_\_\_\_\_ Adımın yüksek lisans tezinde veya bilimsel makalelerde kullanılmasını istemiyorum.

İmzalamış olduğunuz bu form bu araştırmada katılımcı olarak yer almayı ve verdiğiniz bilgilerin araştırma kapsamında kullanılmasında bir sakınca olmadığını kabul ettiğinizi belirtmektedir. Bu form hiç bir şekilde sizin yasal haklarınızdan feragat etmenize yol açmayacaktır. Dilerseniz, araştırmanın herhangi bir anında görüşmeden vazgeçebilirsiniz. Röportaj ve bu form ile ilgili ek sorularınız olursa lütfen aşağıdaki adreslere iletiniz.

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\* Bu formun bir kopyası size iletilecektir.

## APPENDIX J

### OVERALL SUMMARY OF FINDINGS FROM PRIMARY RESEARCH

#### 1. RESEARCH

##### a) Literature review

- The literature review is useful in terms of the exploration of potential product examples, environmentally conscious production methods of glass packaging and alternative materials.
- According to the students, this initial phase would be more inspirational if the product categories were not determined before the literature research.

##### b) Field observation

- The field observation has a little effect on the idea generation phase, since users have different product examples (i.e. food containers) in their houses from the post-use product categories offered by the project brief (i.e. water bottle and candle jar).
- Field observations conducted with people close to the researcher (i.e. the students) are not helpful, as the researcher know or presume mostly their opinions or responses in advance about a specific topic (in that case the post-use of glass packaging).
- Users particularly keep and re-use glass packaging products which they find aesthetically pleasant (based on the results from the field observation).
- Users tend to personalize and modify the products that they like to re-use.
- Users do not prefer to use products of which labels are hard to remove particularly when they use the glass packaging products as decorative objects such as candle jars.

#### 2. IDEA GENERATION PHASE

##### a) Matrix exercise

- The matrix exercise has helped students to generate ideas for both use and post-use phases of the products within a wider perspective.
- It has helped the students develop ideas within a short time; that is, the students save time through this exercise when developing ideas.
- In some situations ideas cannot be fit well into the specific cells in the matrix exercise (e.g. theme: 'super lid' and dimension: 'evolving'). In such cases, some of the ideas are abandoned and replaced by new ones.
- Themes and dimensions serve as initial but important steps for developing ideas for both use and post-use phases. Secondly, they help students to generate and develop ideas through considering different aspects of the product (i.e. glass packaging).
- Among the idea generation strategies, almost half of the students (n: 11) prefer to consider the post-use phase first, whereas a few students (n: 3) prefer to consider use phase first. Furthermore, several students (n: 7) start developing ideas that they come up with first.

##### b) Task exercise

- The task exercise is useful, since new ideas can be generated throughout this exercise, and the ideas generated in the matrix exercise can be developed further with specific tasks (e.g. a water bottle design solution particularly developed for kids).
- In some cases, the tasks given appear not to be suitable for the idea generated for post-use. For instance, if the user group determined by the student was different from the ones given in the task exercise, that user group specific task would not make much contribution to the idea generation phase.



### c) Scenario building exercise

The scenario building exercise can have little or no effect on the product idea. The main reason for this is usually the product scenarios are likely to be considered when the initial ideas are generated (during the idea generation phase).

## 3. FINAL PRODUCT IDEA

### a) Design considerations for water bottles

- The lids should resist being thrown away or lost, and should be durable enough to resist excessive use.
- The water bottles should be resistant to breakage because it is made of glass.
- The accessories should be cost-effective (i.e. they should not increase the overall cost and the prices of the product).
- The fabric covers should be designed so that the water bottle can give feedback about how much beverage remains inside the bottle.
- Fabric covers should be made of insulating materials so that the temperature of the beverage does not change rapidly.
- The labels should be easy to remove or they should be placed on the other parts of the glass (e.g. lid).

### b) Design considerations for candle jars

- During the post-use there should be an opening for air circulation in order to allow the candle to burn.
- The product accessories should be decorative (e.g. various cut-outs on it), since the candle jar is a decorative object. Through decorative accessories candle jar can create various light and shadow effects.
- Similar to the product accessories, the form of the glass (e.g. gravures on the glass) can be used to create such light and shadow effects.
- The lids have a great importance for the post-use phase; they can be used for decorative purposes like creating attractive environments as much as functional purposes like placing the labels on.
- The labels should be easy to remove or other places (e.g. lid) should be used for labels instead of glass surface, since users do not want to use products of which labels hard to remove.

### c) Propose scenarios and product accessories

- There are mainly three scenarios for post-use: selling the product with its accessories for post-use, seeing the product and accessories separately and bringing the product to a small-scale manufacturer to make changes on the product for post-use (e.g. flock coating).
- According to interviews with manufacturer selling the product accessories along with the product seems to be most feasible solution, since it may decrease the overall cost of the product for the manufacturer and overall price for the user.
- For the water bottles the most popular accessory is fabric cover or sleeve. For the candle jars, the lids serving as accessories and stickers allowing users to personalize their products are included in a few design ideas, which may lead users to revalue their products.
- The reference to the use phase is sometimes maintained, so that the product can convey the information and meaning that 'this product has a post-use feature' to the users.
- The removal of the labels is offered, since users may want to use 'new' products and also they do not want to use the products which have still labels on their surface.