EXPERIENCE REFLECTION MODELLING (ERM) AS A GENERATIVE RESEARCH METHOD AND STUDENT ENGAGEMENT IN PRODUCT DESIGN AT UNDERGRADUATE LEVEL

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ABSTRACT

EXPERIENCE REFLECTION MODELLING (ERM) AS A GENERATIVE RESEARCH METHOD AND STUDENT ENGAGEMENT IN PRODUCT DESIGN AT UNDERGRADUATE LEVEL

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Research approaches driven by design thinking have the potential to bridge early stages of design process to idea generation phases in design education. Generative research is emerged from participatory approach which is used at early stages of design process aims to elicit user needs, experiences, expectations and preferences by using generative tools and techniques through helping non-designer participants express their thoughts, feelings, opinions effectively independent of their skills and abilities in research process. Within the context of this thesis, a research method namely Experience Reflection Modelling (ERM) has been developed and incorporated into various educational cases in the third-year industrial design studio at the undergraduate level at the Middle East Technical University (METU). The ERM as a design research method is emerged from participatory approach and generative research. It is the combination of tools and techniques that are strategically put together to enable people's involvement in early phases of design process, and connects design students and potential users through creating an effective medium for knowledge transfer. In this study, investigating the implication of the ERM for design education, and exploring the tools and the techniques enriching student engagement in the ERM method are the main emphases. The ERM in design education focuses on bridging the gap between research phases of design process and idea generation phase through providing design students with skills and techniques for uncovering user knowledge. It also encourages design students to integrate user knowledge into their design knowledge for idea generation. This thesis provides reflections on design research based on the doctoral study and guidelines considering the factors affecting student engagement (e.g. clarity, professionalism involvement of the participant, time planning, collaboration, etc.) for the design educators who would like to incorporate the ERM into an educational project.

Keywords: Design Research Methods, Design Education, Experience Reflection Modelling (ERM), Student Engagement, Generative Research

ÖZ

LİSANS DÜZEYİNDE ÜRÜN TASARIMINDA BİR YARATICI TASARIM ARAŞTIRMASI YÖNTEMİ OLARAK DENEYİM YANSITMA MODELLEMESİ (DYM) VE ÖĞRENCİ KATILIMI

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Tasarım düşüncesiyle desteklenen araştırma yöntemleri, tasarım ve fikir geliştirme süreçleri arasında köprü kurulmasına imkan verir. Tasarım sürecinin erken aşamalarında kullanılan ve katılımcı yaklaşımlardan gelen yaratıcı araştırma, kullanıcı ihtiyaçlarını, deneyimlerini, beklentilerini ve tercihlerini farklı araç ve teknikler kullanarak açığa çıkarmayı amaçlar. Bu araç ve teknikler, tasarımcı olmayan kişilerin bilgi ve becerilerinden bağımsız olarak tasarım sürecine etkili bir şekilde dahil edilmesini sağlar. Bu tez kapsamında, Orta Doğu Teknik Üniversitesi (ODTÜ) Endüstri Ürünleri Tasarımı üçüncü yıl tasarım stüdyosundaki eğitim projelerinin tasarım süreçlerinine entegre edilerek Deneyim Yansıtma Modellemesi (DYM) isimli bir araştırma yöntemi geliştirilmiştir. Bir tasarım araştırması yöntemi olarak katılımcı yaklaşımlardan ve yaratıcı araştırmadan etkilenen DYM, insanların tasarım sürecine katılımını sağlayan araç ve teknikleri yöntemli olarak bir araya getirir ve tasarım öğrencileriyle olası kullanıcıları etkili bir bilgi akışına olanak veren bir ortamda buluşturmayı amaçlar. Bu doktara çalışmasında temel odak, DYM'nin tasarım eğitimindeki uygulamalarının araştırılması ve yöntemin uygulaması sırasında öğrenci katılımını zenginleştiren araç ve tekniklerin incelenmesidir. Tasarım eğitiminde DYM, tasarım öğrencilerine, kullanıcı bilgisini açığa çıkarmak için gerekli beceri ve teknikleri sağlayarak, araştırma süreciyle fikir geliştirme süreci arasında köprü kurmayı hedefler. Aynı zamanda, bu yöntem, fikir geliştirme süreci için öğrencilerin, kullanıcı bilgisi ile tasarım bilgi ve becerilerini bir araya getirmelerine olanak verir. Bu tez, doktora çalışmasına konu olan tasarım araştırmasına yönelik araştırmacının deneyimlerini yansıtır. Ayrıca bu çalışma, DYM yöntemini tasarım eğitimi projelerinde kullanmak isteyen eğitimciler için öğrenci katılımını güçlendiren etkenler dahilinde (ör. açıklık, profesyonellik, katılımcıların katılımı, zaman planlaması, işbirliği) geliştirilen bir rehber sunar.

Anahtar Kelimeler: Tasarım Araştırması Yöntemleri, Tasarım Eğitimi, Deneyim Yansıtma Modellemesi (DYM), Öğrenci Katılımı, Yaratıcı Yöntemler

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CHAPTER 1

INTRODUCTION

Early understanding of industrial design was based on vast range of goods manufactured by mass-production methods (Heskett, 1987) and it was product-centred rather than human-centred. Papanek (2000) pointed out, the lack of social responsibility in early attitude of industrial design. In time, with user demands and current cultural, economic and environmental conditions, a paradigm shift has occurred in the profession of design from product-centred to human-centred. With the need to redefine industrial design profession, many new design definitions concerning new demands of society and technology have emerged. Design is a creative and analytical process in which designers develop products, services, processes and systems by taking into account of individual, social, cultural, environmental, technological and economic considerations in the whole life span ("What is Industrial Design?", 2011; "Industrial Design Profession", n.d.; "Definition of Design", n.d.). Design is an innovative and human-centred process which is proposing new values, new way of thinking. It is open to adopt itself according to changes in technology and lifestyles, and also able to reshape them. Design, is an activity that bridges the gap between socio-cultural and techno-economical dimensions of production and consumption systems. Consequently, design should not only promote innovation, but also satisfy emerging demands with new solutions (Macdonald, S. ed., 2004). Designers research and explore people, their needs, behaviours, expectations and preferences to define emerging demands, problems to be solved, and incorporate local knowledge into design process. Then, they develop possible ways of solving the problems, and present their ideas through sketching, illustrating, etc. ("What is Industrial Design?", 2011; "Industrial Design Profession", n.d.; "Tanım", n.d.). The transition in the meaning of design practice moved from giving form to artefacts or craft objects to designing products by considering human beings (Denton & McDonagh, 2003; Boyarski, 1998). By this transition, design education has uncovered the potentials of human factors, experience, interactions, and behaviours in product design and development process (Breslin & Buchanan, 2008; Boyarski, 1998); and design research has become prominent in the area of design education.

Competences of students involving skills and knowledge such as critical thinking, exploration, accessment, analysing information and creativity to deal with complex problems (Scheer, et al., 2012; Wagner 2008) can be given to design students through a more constructivist educational environment. This enables students to construct knowledge, analyse and synthesize it for problem defining and solving. Industrial design studios in design education has common characteristics with constructivist education approach in terms of providing design students with experience for constructing design knowledge and encouraging them to develop design solutions. In design studios, students are provided with skills and knowledge to analyse and reflect knowledge in a constructivistic way through design process (Kurt, 2011). Studios are the core of design education where design students experience a design process thoroughly from early stages to finalization of design. At studios, design students are taught to organize and present their works for critics, however teaching to justify their works based on critical reflection is needed in design education (Souleles, 2013). Intellectual rigor in design education is lacking, because, design process focuses on subjective tacit knowledge and creativity of students rather than explicit knowledge emerged from design research (Wang, 2010). In the current understanding of design education, it mainly focuses on subjective creativity of design students; however design research provides more rigorous design process through compiling it with objective rationality (Wang, 2010). Design knowledge is nourished by both design process and research (Szeto, 2010). While design process develops tacit knowledge and creativity of students, design research generates explicit knowledge released from the domain of research. In design education, tacit knowledge informing subjective creativity and research knowledge informing objective rationality should be balanced to enable students to tackle with defining and solving problems in a more critical and rigorous way. It can be achieved by integrating research at early stages of design process. So far, many design departments have integrated research into their curriculum to enable their students to use research knowledge contributing to a more rigorous design process (Wormald, 2011; Arnold, 2009; Buchanan, 2004). Research in design education enables students to expand their design knowledge and skills through deeper understanding of people and design context.

According to Oygur and Blossom (2010), Turkish designers mostly rely on their personal and professional experiences together with an intuitive approach during idea generation phases. However, this approach is not always successful to fulfil the needs and expectations of a user regarding a product. Although, Turkish designers accepted the importance and the potentials of user research in design process, they believed that they weren't well equipped in rigorous research methods during design education (Oygur & Blossom, 2010). Thus, the ways to adapt and integrate research methods into design process start with design education. Expanding knowledge and skills of design students on research would help them create their own design and research processes for their future professional life.

Design research mainly focuses on fuzzy front end of design process which aims to find and define problems (Wormald, 2011; Oygur & Blossom, 2010) through identifying research area, selecting relevant contexts, collecting relevant data, analysing data, and presenting findings (PuayHwa,2012). However, implication of design research for idea generation is unclear and unpredictable unless it is incorporated into problem solving phases. Thus, research in design education should bridge very early stages of design process with idea generation phases. To this end, design research approaches driven by design thinking in education are needed to explore and understand people's needs, preferences, behaviours and expectations. Participation of people in those approaches depends on how design researcher defines the role of people. People are considered not only as subjects, users, consumers, but also true experts in domains of experience and co-creator in design process (Sanders, 2008; Sanders & Chan, 2007). To elicit their tacit knowledge and better understand the context of experience, active participation of people in design research for idea generation phase of design process has gained importance (Sleesvijk Visser, 2009; Sleesvijk Visser, et al., 2005). Participation of people in design process is not a new approach. Participatory design rooted to 1960s and 1970s in the Scandinavian countries in order to encourage and support involvement of people in various phases of design process to democratise the decisions and solutions developed for people (Bjögvinsson, et al., 2012; Robertson & Simonsen, 2012). So far, this approach has evolved based on the tools and techniques used in design and research process. Generative research emerged from participatory approach which is used at early stages of design process aims to elicit user needs, desires and preferences by using generative tools and techniques such as Velcro modelling, mind mapping, collage, et cetera. These tools and techniques help non-designer participants express their thoughts, feelings, opinions comfortably independent of their skills and abilities in research process (Levitt & Richards, 2010; Sanders et al., 2010; Arnold, 2009; Hanington, 2007).

Within the context of this study, a research method namely Experience Reflection Modelling (ERM) has been developed and incorporated into various educational cases at the undergraduate level of industrial design at the Middle East Technical University (METU). The ERM as a design research method emerged from participatory approach and generative research is the combination of tools and techniques that are strategically put together to enable people's involvement at early stages of design process, and connects design students and potential users through creating an effective medium for knowledge transfer. The ERM in design education focuses on bridging the gap between very early stages of design process and idea generation phase through providing design student skills and techniques for revealing user knowledge, and encouraging them to integrate their design knowledge into user knowledge for idea generation. In this study, investigating the implication of the ERM for design education and exploration of the tools and the techniques enriching student engagement in the ERM method are the main focus. Engagement has been taken into account, since keeping students engaged and attentive at each phase of the ERM is critical for students' performing tasks in the phases and adapting their skills and knowledge acquired from the ERM into their future professional design life.

1.1 Aim of the Thesis and Research Questions

The aim of the doctoral dissertation is to develop and integrate the ERM into industrial design education as a generative research method which enriches students' experience of engagement during human-centered research in product design and development process at undergraduate level. This thesis provides guidelines for the educators who would like to incorporate the ERM into an educational project. Within the scope of the aim of the thesis, there are three major research questions:

1. How can the ERM method be integrated into product design and development process in design education at undergraduate level?

- What is the sequence of the ERM in product design and development process?

2. Which techniques and tools can be incorporated into the ERM to develop it further?

- How do the context, tools and techniques enhance involvement of the people in the ERM sessions?
    - How can the 3D modelling experience be improved further?
- How can innovative and creative design solution areas be generated by design students at the analysis phase of the ERM that provide input for idea generation?
- How do these techniques relate to each other?

3. How can the ERM enrich novice designers' engagement with the tasks during generative research phase of design process?

- What are the motives and barriers of students in the ERM process?
- What are the factors that affect student engagement in the ERM process?

1.2 Structure of the Study

This thesis was initiated by the exploration of the research area. The development of the structure of the thesis started with scrutinizing the literature and conducting a preliminary study. After defining the border with the development of the ERM, a series of exploratory field studies were conducted. The structure has been informed and evolved by the findings after each field study. The outline of this thesis is presented in Figure 1.1.

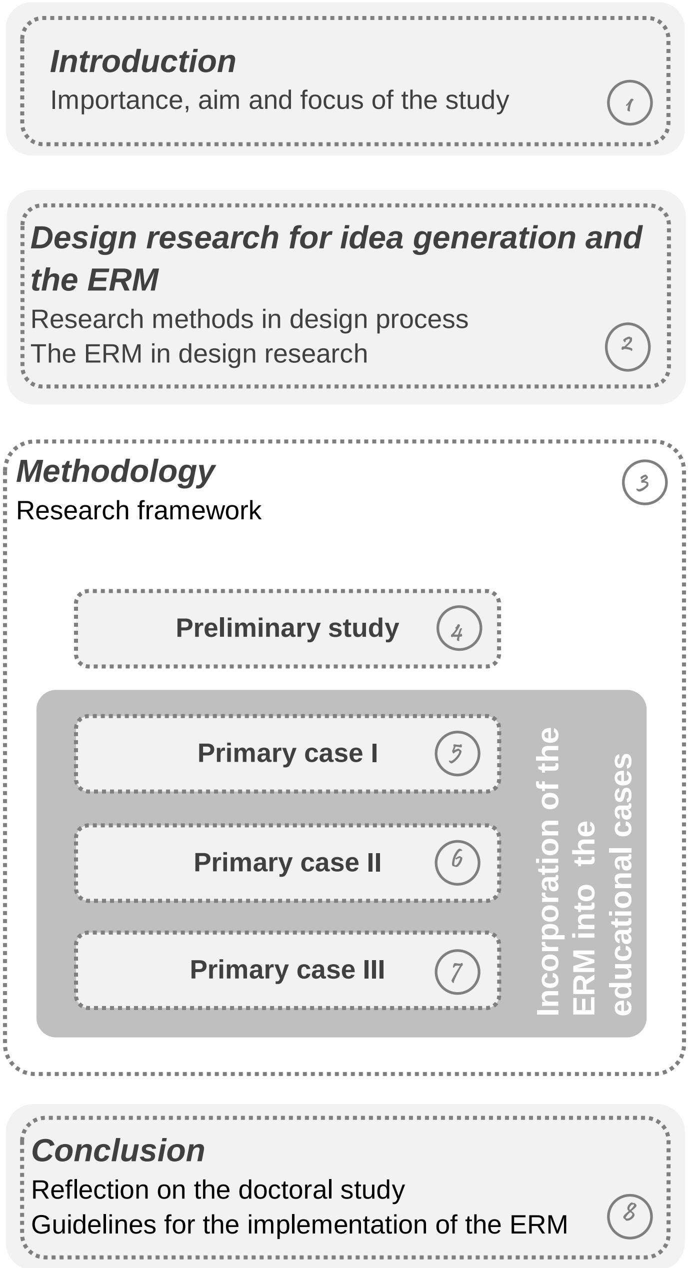


Figure 1.1 The structure of the thesis

This first chapter presented the importance, aim and research questions of this study.

Chapter 2 presents design research for idea generation phase. It starts with the literature review about the importance of research for design process and design education, the importance of user involvement in design research and in idea generation phase, and generative research in design process. After presenting the literature, this chapter defines the ERM in the context of design research with the tools and techniques used. It continues with the relationship of the ERM with design considerations of the educational cases presented in the following chapters. It concludes with the characteristics of the ERM in terms of generative research, participants and students, product design and development process, and sustainability.

Chapter 3 describes the research methodology with the research approach. This thesis is based on one preliminary study and three field studies. This chapter concludes with the presentation of the data collection and the analysis procedures with the researcher's reflections, and the limitations.

Chapter 4 presents the preliminary study which explores the implications of user observations for the post-use product design solutions. This study is composed of an in-depth interview and an online survey. The conclusions from this study helped the researcher define the problem statement.

Chapter 5 presents the first incorporation of the ERM as a generative research method into an educational project namely "My Sustainable Mini Oven". This study is descriptive in terms of the tools and techniques used in the ERM, and focuses on the implementation of the ERM in the design process. The conclusions from and the limitations of this study lead to the next field study presented in Chapter 6.

Chapter 6 presents the second implementation of the ERM in an educational case namely "Making Tea as an Engaging Practice: Electrical Tea Maker with its Serving Set". This chapter explains the phases of the ERM with the improvements after the first implication, and the field study conducted to gain feedback regarding the phases of the ERM. The field study composes of both qualitative and quantitative parts. In the qualitative part, the findings based on the ERM phases, the implications of the ERM for idea generation, and the potentials and limitations for future adaptations of the ERM are presented. And then, the quantitative part is discussed for the assessment of the findings from the qualitative part of the study. This chapter concludes with the suggestions for the further study on the ERM.

Chapter 7 is the last chapter presenting the field studies. In this chapter, changes on the ERM method that has been incorporated into an educational project, namely "Engaging and Sustainable Design Solutions for Tea Making and Serving Experience", are explained in detail with the findings and conclusions from the field study aiming to gain further feedback from the design students about those changes.

Chapter 8 discusses the researcher's reflections on design research based on the doctoral study. It presents guidelines for the implementation of the ERM in design process based on the factors affecting student engagement, and explains the limitations of the ERM implementation in this thesis study. This chapter concludes with the projections on future adaptations of the ERM for design education, and suggestions for the further research.

CHAPTER 2

DESIGN RESEARCH FOR THE IDEA GENERATION PHASE OF DESIGN

Design research offers a systematic approach towards knowledge generation that has the potential for inspiring and informing every phase of design process. Design research at early stages of design process enables designers to gain insights into and knowledge about a particular domain, and helps them synthesize their design knowledge for creative and innovative design solutions.

Firstly, the importance of research for design process and education will be discussed, then the importance and the role of user involvement in idea generation phase will be explained. This chapter will end with generative research approach along with the exemplary tools, and the tools and techniques the ERM method involved.

2.1 The Importance of Research for Design Process and Design Education

The meaning of design has been interpreted through different approaches such as form giving (Alexander, 1964), decision making (Asimov, 1962), problem solving (Archer, 1965), and initiation for change (Macdonald, ed., 2004; Manzini 1994; Papanek, 1985; Jones, 1980). In the early understandings of design, designers were required to focus on how to turn a mechanical function into an aesthetic material form (Stappers, 2006). However, in design process, it is rather challenging to take into account all factors affecting design solution including a variety of issues such as human factors, material selection criteria, manufacturing processes, context of use, user interactions, socio-cultural and environmental considerations, et cetera. In the newer understanding, design can be considered as an innovative and human-centred process proposing new values, new ways of thinking, which is not only open to the changes in technology and lifestyles but is also able to reshape them. The transition in the meaning of design practice moved from form giving of artefacts or craft objects to designing products by considering human beings (Denton & McDonagh, 2003; Boyarski, 1998). Products refer to artefacts, services, interactions and systems that are created through a design process by a designer. By this transition, design education has uncovered the potentials of human factors, experience, interactions, and behaviours in product design and development process (Breslin & Buchanan, 2008; Boyarski, 1998); and design research has become prominent in the area of design education. Henry Dreyfuss was the pioneer in studying people’s behaviours and attitudes in design process. So far, many design departments have integrated research into their curriculum to enable their students to use research knowledge contributing to a more rigorous design process (Wormald, 2011; Arnold, 2009; Buchanan, 2004). Research in design education helps students follow a design process through interpretation, reflection, and reframing of data for developing design solutions, and expand their knowledge and skills through deeper understanding of people and design context.

Design is an iterative process, which is divided into design phases that is nourished by the knowledge retrieved from researches or by the tacit knowledge of designers. Designers' tacit knowledge and skills in design process are not sufficient solely to develop creative and innovative products. Design process needs the explicit knowledge gathered from research through emboldening designers to encounter real occasions in which people are involved. The recognition of new research methods in design education enables students to broaden their understanding of design based on user knowledge, and enhance their creativity in problem solving (PuayHwa, 2012; Bennett, 2006; Buchanan, 2004; Boyarski, 1998). Learning to conduct a research and use of research knowledge in design process enables students to become knowledge makers rather than knowledge users (Carr & Kemmis, 1986 in PuayHwa, 2012). If this knowledge comes from people, it becomes insightful for the development of meaningful design.

Arnold, et al. (2007) categorized design practice according to the source of knowledge as *intuitive, informed, ethnographic design,* and *participatory co-design*. In *intuitive design*, designers put themselves in users' place (Hasdoğan, 1996) with respect to their own experiences; in *informed design*, user knowledge is provided from outside of design team; in *ethnographic design*, people are the subject of research conducted by designers; and in *participatory design*, people are involved in design process through methods that aim to help them express their hopes, dreams, and creativity. Because of the uniqueness of designers' behavioural and cognitive processes (Cross, 2006), design is a novel practice in terms of use of knowledge (Eder, 1966). Beside the use of designers' tacit knowledge, research methods are used to elicit knowledge that will be incorporated into design process through exploring and understanding design context. The design context involving physical, cognitive, social, cultural and emotional contexts (Kumar, 2009) cannot be considered separate from people. Understanding people's need, behaviours, attitudes, experiences and dreams is very essential to explore design context and inform design process. Thus, the importance of human-centred research and people's involvement in diverse extents in research methods will be discussed in the following sections.

2.2 The Importance of User Involvement in Design Research

Designers create artefacts, products, services and systems for people; and they should be an integral component of design process (Hanington, 2007; Mitchell, 1995). Although this integration of people into design process varies from an observant to an active participant according to different research methods (e.g. from user observation to participatory techniques), people involvement aims to extend and inform designers' knowledge about specific design area, and to expand designers' viewpoint (IDEO, 2009; Suri & Howard, 2006; Sleeswijk Visser, et al., 2005; McDonagh-Philp & Denton, 1999) through understanding context of use, people's needs, experiences and preferences.

Use context implies, "all factors that influence the experience of a product use" (Sleeswijk Visser, et al., 2005, p.121). Kumar (2009, p. 93) explains five types of context to explore those factors more profoundly as:

> *Physical*: How do people experience their physical interaction with things?
> *Cognitive*: How do people associate meanings to things they interact with?
> *Social*: How do they behave in teams or in social settings?

Cultural: How do people experience shared norms, habits, and values?
Emotional: How do people experience their feelings and thoughts?

(Kumar, 2009, p. 93)

A better understanding of the use context associated with people's experiences in terms of time and environment would help designers avoid biases, since designers tend to make assumptions about users based on their own experiences and mental models. In design process, designers may create solutions through their projections about future uses and users through their experiences, if the knowledge retrieved from human-centred research is absent (Oygur & Blossom, 2010; Ornetzeder & Rohracher, 2006). When mental gap between people and designers expands, design solutions may be used in an unintended way or may not be accepted by people.

Although the importance of understanding the context has been discussed in the previous paragraph, the context is only related to past experiences and present activities within a particular time and environment. Additionally, designers need to explore future dreams of people in design process in order to set acceptable and appropriate objectives for design solutions. To this end, the context of human-centred research has broadened due to the factors that are intended to be explored in order to enrich design process. In the next section, people's involvement in idea generation phase of design process from former understanding of human-centred research to recent understandings and approaches will be discussed.

2.3 Users' Involvement in Idea Generation Phase

"We can know more than we can tell"

Polanyi, 1983, p.4

During 1960s and 1970s, rigorous scientific methods were thought as the limitation of creativity and intuitiveness of designer. Fleishman (1958) states research as "a fancy way of telling him (the designer) something he already knows through long experience" (Fleishman, 1958, in Arnold, et al., 2007, n.p.). However, research helps designers expand their knowledge through criticizing their mental models with research knowledge.

The popularity of research in design profession has begun during 1970s and 1980s when design firms began to employ social science researchers in order to utilize their knowledge on research for formulating design research process and methods (Arnold, et al., 2007). 1990s were the rise of recognition of design research among designers as the effects of social sciences. These effects were begun to be felt in the industrial design community (Darrel Rhea, personal interview, 9 November 2004 in Arnold, et al., 2007). As a result, ethnographic research methods, which aim to study and learn about a person or a small group of people in order to "theorize about culture at a more general level" (Plowman, 2003, p. 32), are modified to fit the demand of product development (Arnold, et al., 2007). Thus, many research methods (e.g. user observation, in-depth interview) informing design process have been mainly adopted from research-led perspective and social sciences, which appears to be not aligned with the nature of design thinking.

Today, many research methods have been developed for and integrated into design process in order to explore and understand people's needs, behaviours, attitudes and dreams. Methods may not only come from research-led perspective but also from design-led perspective. The research-led perspective driven by social sciences has longer history in design profession, while the design-led perspective is a new approach driven by design thinking (Sanders, 2008; Sanders & Chan, 2007). Involvement of people in those perspectives depends on how researcher defines people. It may range from expert mind-set to participatory mind-set. For instance, in expert mind-set, people are considered as subjects, users, consumers, etc., on the other hand, in participatory mind-set, people are considered as true experts in domains of experience and co-creator in design process (Sanders, 2008; Sanders & Chan, 2007). The origin of participatory approaches is rooted in 1960s and 1970s in Scandinavian countries where people demanded to have a voice in the decisions having effects on their lives such as organization of work places, changes in planning of production, division of labour in work spaces, introduction of new technologies, et cetera (Bjögvinsson, et al. 2012; Robertson & Simonsen, 2012). Participatory design aims to encourage and support direct involvement of people in various stages of design process to democratise the decisions and solutions developed by design process. People in a participatory design are active partners whose opinions are regarded as design decisions (Bjögvinsson, et al. 2012; Robertson & Simonsen, 2012). Participatory design adopted both research-led and design-led perspectives. While Scandinavian approach in early attempts of participatory design has been inspired and informed by research-led perspective, contemporary approaches in this field has begun to convey design-led perspective through developing and using innovative and generative tools which are more aligned with design thinking (Sanders, 2008; Sanders & Chan, 2007).

As discussed earlier, defining user in design research is changing; accordingly the roles of people are also changing. Previously, people were referred as consumers or customers of a product. Later on, in Scandinavian countries, in 1980s and 1990s with the emergence of user researches in design profession, people were regarded as users, and the significance of user-centred design process had risen (Sanders, 2006). User-centered research values people as the source of user knowledge through their involvement in design research. Although user-centred design research appears to be widespread in design process, particulary people's participation in idea generation phase of design process has increased in order to elicit people's tacit knowledge to better understand the context of experience and future latent needs (Figure 2.1).

The means of people's involvement in design research is critical for the depth of knowledge to be gathered. Tacit knowledge cannot be retrieved from what people say, because it is the knowledge that people can act upon (Polanyi, 1964). In addition, latent needs cannot be retrieved from what people say either, because people are not aware of them yet (Sanders, 2001). The way that design researcher refers people will affect the way that people act in research process. For instance, Sleesvijk Visser, et al. (2005) categorize the types of knowledge being gathered and the types of people's action according to the types of techniques being used in design research in Figure 2.1.

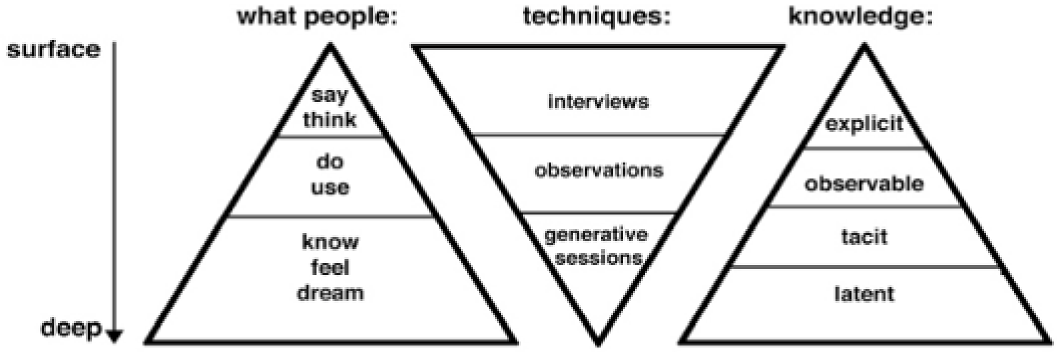


Figure 2.1 Different levels of knowledge accessed by different techniques (Sleesvijk Visser, et al., 2005)

According to Figure 2.1, generative tools and techniques aiming to release participants' knowledge, feelings and dreams regarding an issue are used to gather more profound knowledge from design research process. Many generative research tools which are aligned with the nature of design thinking (i.e. mood boards, collages, mind mapping, Velcro modelling, etc.) have been developed to better understand people's needs, experiences, and expectations.

The main emphasis of the doctoral study will be on the means of bringing together generative tools within the context of the ERM to encourage student engagement. The ERM as a generative method helps students explore design considerations, and help them generate new knowledge with people rather than design with people. In the following section, generative research incorporated into idea generation phase of design will be explained through examples from design-led perspective.

2.4 Generative Research at Idea Generation Phase of Design Process

Design process involves three stages of research such as exploratory, generative and evaluative methods of research (Figure 2.2). Exploratory research aims to gather a comprehensive understanding of people and research context by using surveys, questionnaires, observations. Moreover, exploratory methods, which include photo and diary studies, contextual inquiry, and cultural probes aiming to elicit human experiences, are ethnographic in nature. Generative research focuses on understanding user needs, desires and preferences more profoundly (Hanington, 2007). Because of the iterative nature of design process, phases of research tend to overlap unlike a linear process. Exploratory and generative research can be used as complementary research approaches to inform early stages of design process for idea generation. Thus, generative and exploratory phases of design may include similar and/or complementary methods.

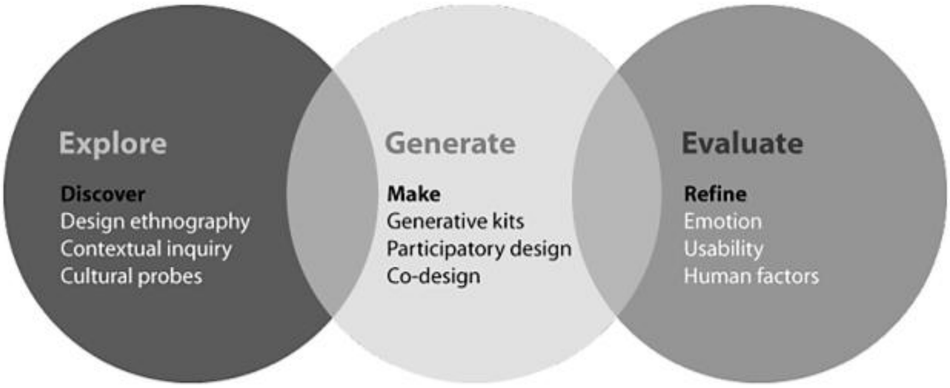


Figure 2.2 Model of design research (Hanington, 2007)

Before discussing the techniques used in generative research, the definitions of approach, method, technique, toolkit and tools will be clarified to better understand the differences between them.

> *Approach* describes the overall mind-set with which the research plan is conducted (e.g. participating people in the idea generation phase).
> *Method* is a combination of tools, toolkits, techniques and games that are strategically put together to address defined goals within the research plan.
> *Technique* describes how the tools and toolkits are put into action.
> *Toolkit* is a collection of tools that are used in combination to serve a specific purpose.
> *Tools* are the material components that are used in activities.
>
> (Sanders et al., 2010, p. 196)

Generative research involves three dimensions such as form, context and purpose of tools and techniques that will be used. Form describes actions of participants in a generative research activity such as making, telling and enacting due to the purpose of the process. Context describes whether tools and techniques are used by a group or by individual via face to face or online sessions (Sanders et al., 2010). The type of form and context depends on the purpose of the generative research technique that will be conducted in a research method. The purpose of generative research techniques can be categorized differently; however these categorizations show similarities and overlappings in their intents and implications for design research (Levitt & Richards, 2010; Sanders et al., 2010; Hanington, 2007). It could be also difficult to propose that there are clear-cut borders among the stages of generative research, since same or similar tools and techniques can be used in more than one stage. For instance, collage can be used for all stages whereas Velcro modelling can be used for later stages such as understanding, generating, constructing or creating (Table 2.1).

Sanders et al. (2010) describe the purposes of generative techniques through four dimensions such as:

- probing participants for a research topic,
- priming participants in order to immerse them in the domain of interest,
- understanding their current experiences, and
- generating ideas or design concepts of the future.

Hanington (2007) specifies the purposes of generative techniques as projective and constructive. Projective techniques, which are generally used at early stages of generative process, focus on exercises enabling participants to express thoughts, feelings and desires which are difficult to communicate through more conventional verbal techniques. This process includes collage, drawing, diagramming, image and text-based exercises. Constructive techniques, which are used in later stages of generative process, focus on exercises enabling participants to create and develop flexible and creative concepts on considerations defined by projective techniques (e.g. Velcro modelling). Levitt and Richards (2010) define purposes of generative techniques as priming, dreaming and creating. Priming aims to prepare participants for the research topic by immersing them in their current behaviours, thoughts and feelings. Dreaming aims to disclose hidden or subconscious thoughts and emotions through enabling the researcher to understand current experiences and future expectations of participants. Creating aims to build solutions that integrate participants' dreams for the future (Table 2.1).

Table 2.1 *Comparison of stages of generative research*

Stages of Generative Research

Probe	Prime	Understand	Generate	Sanders et al. (2010)
Project		Construct		Hanington (2007)
Prime	Dream		Create	Levitt and Richards (2010)

The purpose of generative research conducted with people designates the type of tools and techniques that will be used in generative research process. Different types of generative tools and techniques can be used according to the form mentioned above (i.e. making, telling and enacting). For instances, diaries, cards with images or text, logs, workbooks can be used to encourage people to talk and explain in detail about their experiences and thoughts, while Velcro modelling, collages and mind-mapping can be used to trigger people to make tangible things that represent their thoughts and experiences. Those techniques can be conducted individually or collectively through online mediums or face to face sessions (i.e. context of generative research). Sanders et al. (2010) formulates the framework of techniques according to the form, purpose and context dimensions of generative research (Table 2.2). However, it should be noted that one kind of technique can be used in various forms, contexts and purposes if it is designed due to the factors that are need to be considered during design research process. The categorization of tools and techniques in Table 2.2 depends on what participants do during generative research sessions (e.g. making tangible things, talking, telling, acting, etc.).

Table 2.2 *Tools and techniques used in generative research method (reproduced from Sanders et al., 2010)*

	TOOLS & TECHNIQUES	PURPOSE: Probe	PURPOSE: Prime	PURPOSE: Understand	PURPOSE: Generate	CONTEXT: Individual	CONTEXT: Group	CONTEXT: Face To Face	CONTEXT: On-Line
MAKING TANGIBLE THINGS	2-D collages using visual and verbal triggers	●	●	●	●	●	●	●	●
	2-D mappings using visual and verbal components		●	●	●	●	●	●	
	3-D mock-ups using e.g. foam, clay, Legos or Velcro-modelling			●	●	●	●	●	
TALKING, TELLING AND EXPLAINING	Stories and storyboarding		●	●	●	●	●	●	●
	Diaries and daily logs	●	●	●		●		●	●
	Cards to organize, categorize and prioritize ideas			●	●	●	●	●	
ACTING, ENACTING AND PLAYING	Game boards and game pieces and rules for playing		●	●	●	●	●	●	
	Props and black boxes			●	●	●	●	●	
	Participatory envisioning and enactment				●	●	●	●	
	Improvisation				●	●	●	●	

These tools and techniques allow non-designers to express their thoughts and opinions during generative sessions (Arnold, 2009). They can be diversified, and different generative techniques can be used together according to the purpose of the research (Sanders, 2000). However, in the following sections, the ones that are widely-used, easy to use for all people and considered as significant for the scope of this study will be explained and exemplified. Acting, enacting and playing is not included, since this category is out of the scope of the study. The author believes that those techniques for acting, enacting and playing highly depend on skills and abilities of people. However, the main emphasis of the doctoral study will be on peoples' involvement in design research process that is independent of their skills and abilities.

2.4.1 Probes

Probes have been developed independent from generative research tools, although it uses similar tools and components (Sleeswijk Visser et al., 2005). “Cultural probes” technique is introduced by Gaver et al. (1999) in order to gain empathic understanding of people’s daily lives and inspirational data for early stages of design process. Gaver et al. (2004, p. 53) states that “probes are collections of evocative tasks meant to elicit inspirational responses from people – not so much comprehensive information about them, but fragmentary clues about their lives and thoughts”. To this end, a package of probe is given to participants to help them complete the given tasks in their domestic environment. This technique provides a deeper understanding about people if it is difficult to observe people in their real context. The toolkit of a probe package contains diverse tasks and tools such as disposable camera to document certain aspects of daily lives with pictures regarding to the given task by the researcher; diaries to write about people’s daily activities; workbooks and postcards to answer questions written on them related to the research topic (Figure 2.3).

Figure 2.3 A probe package (IDEO, 2011)

Tools in probe packages should be simple and enjoyable to eliminate the gap between participants and researchers that may occur during research process (Hemmings et al., 2002), since the researcher will not be with the participants during data collection phases.

Output of probe packages are not designed to be analysed, instead the representation of the output remains unfiltered in order to inform design process, as this is considered as inspirational data. Designers make their own interpretations about the outcomes of probes without aiming to validate and evaluate (Sleeswijk Visser, 2009). Results of a probes study are the personal interpretations of designers to generate inspirational themes in design process (Gaver et al., 2004).

2.4.2 Collages

Collages are used to elicit emotional responses from participants and to obtain a better understanding of people's experiences and feelings about a particular subject (Stappers & Sanders, 2005). It is generally used for preparation of following phases (e.g. Velcro modelling) in generative research. A collage toolkit may consist of both collection of words, and realistic and abstract images. The images can be selected by participants from a magazine provided by the researcher. However this selection process may be exhausted and confusing, therefore previously selected and/or prepared images appears to be more appropriate for this method (Sleeswijk Visser et al., 2005). While composing images for collage, the content is diverse (e.g. people, animal, objects, etc.); the number of positive and negative, abstract and realistic images are equal; research subject related images are absent or minimum such as a picture of a men using a shaver if shaving experience of participants are tried to be explored by collages (Sleeswijk Visser et al., 2005).

In addition to words and images, other tools such as cardboards, scissors, tapes, glues, pen and pencils are given to participants to help them arrange selected images and words according to the given instructions (Figure 2.4). There is no rule in arranging the components, and the instructions intend to be open to avoid misunderstandings (Stappers & Sanders, 2005).

Figure 2.4 Collage making in a generative session (Hanington, 2012)

After the completion of arranging the components, participants present their collage posters verbally by explaining their thoughts while creating the collage (e.g. reasons for selecting a particular image or text). Verbal presentations are essential to better understand participants' insights and to inform the further design process, since visuals are difficult to analyse without explanations (Stappers & Sanders, 2005).

2.4.3 Mind Mapping

Mind mapping is used to externalize ideas related to a topic, and to understand how those ideas are interrelated within people's mind. Mind mapping includes all relevant issues considering the topic and connections between the issues (Tomei et al., 2006; Buzan & Buzan, 2000). In generative research, mind mapping is conducted with participants to explore and understand their thoughts and experiences related to a product or system (Sleeswijk Visser et al., 2005; Stappers & Sanders, 2005), and to elicit the understanding of how a process or system works (Sanders, 2000) through a diagrammatical representation (Figure 2.5). The main topic to be explored is generally located at the central point of this graphical representation, and related issues are structured around the centre.

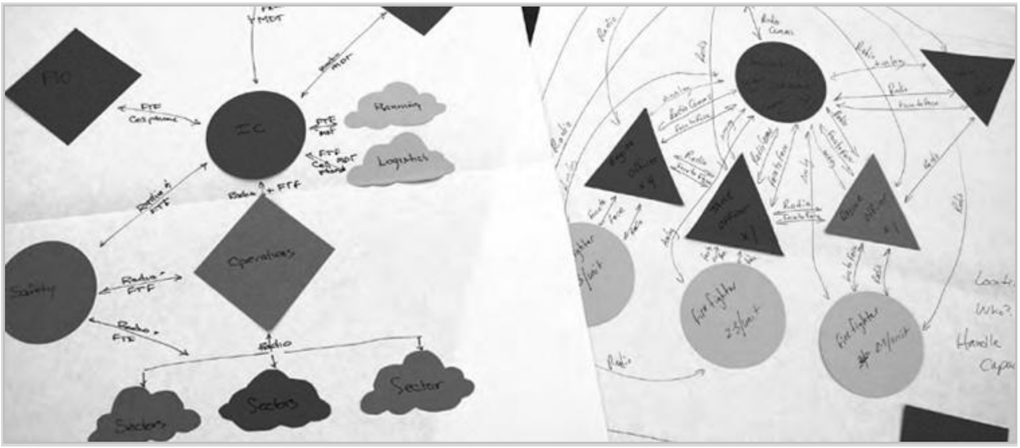


Figure 2.5 Collage map examples (Levitt & Richards, 2010)

Although a pencil and a paper are enough to create a mind map, a mind mapping toolkit can include scissors, glue, tape, collection of words, and simple and abstract shapes such as circles, squares, etc. in different sizes and colours (Stappers & Sanders, 2005). Participants arrange/draw/link components of the toolkit based on the instructions given by the moderator, and explain reasons of the arrangement they make during the process (Levitt & Richards, 2010).

2.4.4 Velcro Modelling

Velcro modelling is a hands-on approach in generative research which allows people to embody their ideas, experiences, needs and expectations of physical objects by using a Velcro modelling toolkit (Sanders, 1992). Velcro modelling sessions are generally conducted after participants are engaged in another exercise (e.g. mind mapping, collage) which helps them think and familiarize about the topic of the research. Sessions can be conducted within a group of people (Figure 2.6) or individually.

Figure 2.6 Velcro modelling session example (Levitt & Richards, 2010)

A Velcro modelling toolkit includes simple and abstract 3D blocks and a variety of attachable 2D shapes with Velcro fasteners that represent various potential components of a product (Levitt & Richards, 2010; Stappers & Sanders, 2005) (Figure 2.7). Although there are other 3D modelling methods in the literature such as rough prototyping with clay modelling, Velcro modelling helps people feel more comfortable in creating forms and explaining their final 3D models, as the medium of creation is independent of participants making skills. The tools are simple and abstract in order "to equalize the fidelity of everybody's output" and enhance their creativity (Levitt & Richards, 2010, p.27).

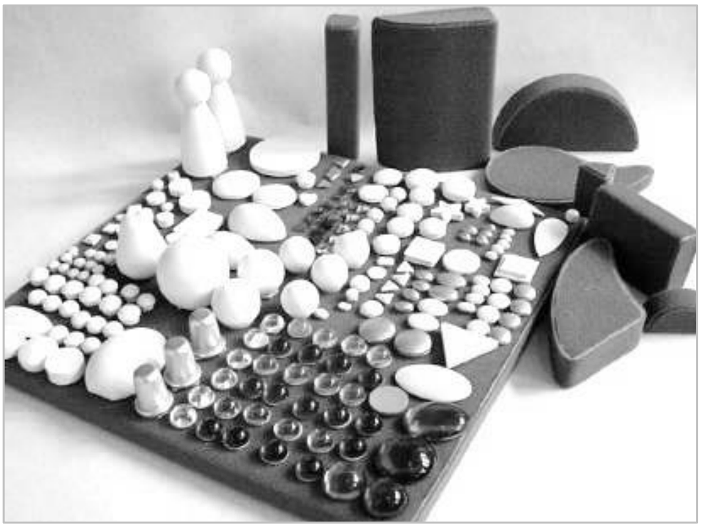


Figure 2.7 Velcro modelling toolkit (Sanders, 2007)

It should be noted that design researcher does not take the outputs created by participants too literally at generative sessions (Levitt & Richards, 2010). Analysing the outputs of Velcro modelling sessions focuses on the explanations of participants while bringing together the parts from generative toolkit. Rather than the final output, the process through which participants provide their insights, priorities and intentions is critical in terms of gathering inspirational data for idea generation phase of design process.

Various tools and techniques used in generative research methods are explained above. They help people express themselves by telling, talking and explaining (e.g. diaries, workbooks), and making tangible things (e.g. collages, Velcro modelling). Making tangible things would provide people to express tacit knowledge and latent needs that could not be expressed verbally. Talking/telling/explaining is essential to probe people for the making process and/or to understand the reasons of their needs, preferences and expectations during the making process. Thus, those two approaches should be used in a complementary way in design research process. On the other hand, the integration of generative tools and techniques into design process, and to what extent they help students explore and understand design considerations at idea generation phase are worth exploring. For those reasons, the Experience Reflection Modelling method was developed and incorporated into three design educational cases at undergraduate level in the Department of Industrial Design at the Middle East Technical University in spring semesters 2010, 2012 and 2013 respectively.

Although various tools and techniques used in generative research are presented along with their purposes and contexts, their incorporation into educational cases and their implications for idea generation of design process are not clearly defined in the literature. Moreover, student engagement during the implications of generative research in design process is not mentioned in the literature. Therefore the literature review about the implications of generative research for student engagement in design process is an initiation point for this doctoral study, whereas the educational cases as the integral parts of the study are the main source for the development of the ERM.

2.5 Experience Reflection Modelling (ERM)

Experience Reflection Modelling (ERM) is a design research method that is emerged from participatory and generative approaches encourages people's involvement at early stages of design process, and connects design students and potential users through creating an effective medium for knowledge transfer. It focuses on the integration of user observations and idea generation phases. It brings together 3D modelling, interview, video recording and analysis techniques to help students better understand people's needs, experiences and expectations regarding a product (Figure 2.8). The ERM includes the following three main phases from preparation to analysis such as:

- **Preparation** includes phases for introducing the ERM to students, and students' preparations for the ERM sessions such as toolkit preparation, recruitment, arranging ERM environment, etc.
- **Session** covers activities occurred in the ERM sessions such as interviewing, 3D modelling, documentation, etc.
- **Analysis** phases help students highlight significant and insightful statements made by participants, and identify potential solution areas or emerging ideas regarding design project.

As the ERM has been developed based on the findings from the implementation of it in the design educational cases, the tools used in the ERM phases have incrementally changed at each one. Hence, the details of the tools and the phases will be presented in Chapter 5, 6, and 7.

3D modelling (i.e. mock up and prototyping) actively allows people to reflect their ideas and expressions on a three dimensional model through a hands-on approach by using some special tools (Sanders & William 2001; Sanders, et al., 2010). 3D modelling included in the ERM is based on Velcro modelling explained in the previous chapter; however it has been adopted through major alterations for providing practicality and applicability. For instance, the toolkit utilizes putty-like fasteners (e.g. Tack-it, Blu-Tack) instead of Velcro to bring together the components in the toolkit, since they are more affordable and practical for large volume parts in the toolkit. Additionally, the toolkit includes various materials such as coloured pens and pencils, paper tape, string, wire, play-dough, various types of papers, fabrics, etc. to tailor the model to the specific requests or needs of participants. Unlike many other 3D modelling techniques, constructing the 3D model is independent from people's abilities and skills, since the ERM toolkit provides diverse 3D and 2D parts along with supplementary materials. 3D models of the ERM sessions can be considered as rough mock-ups.

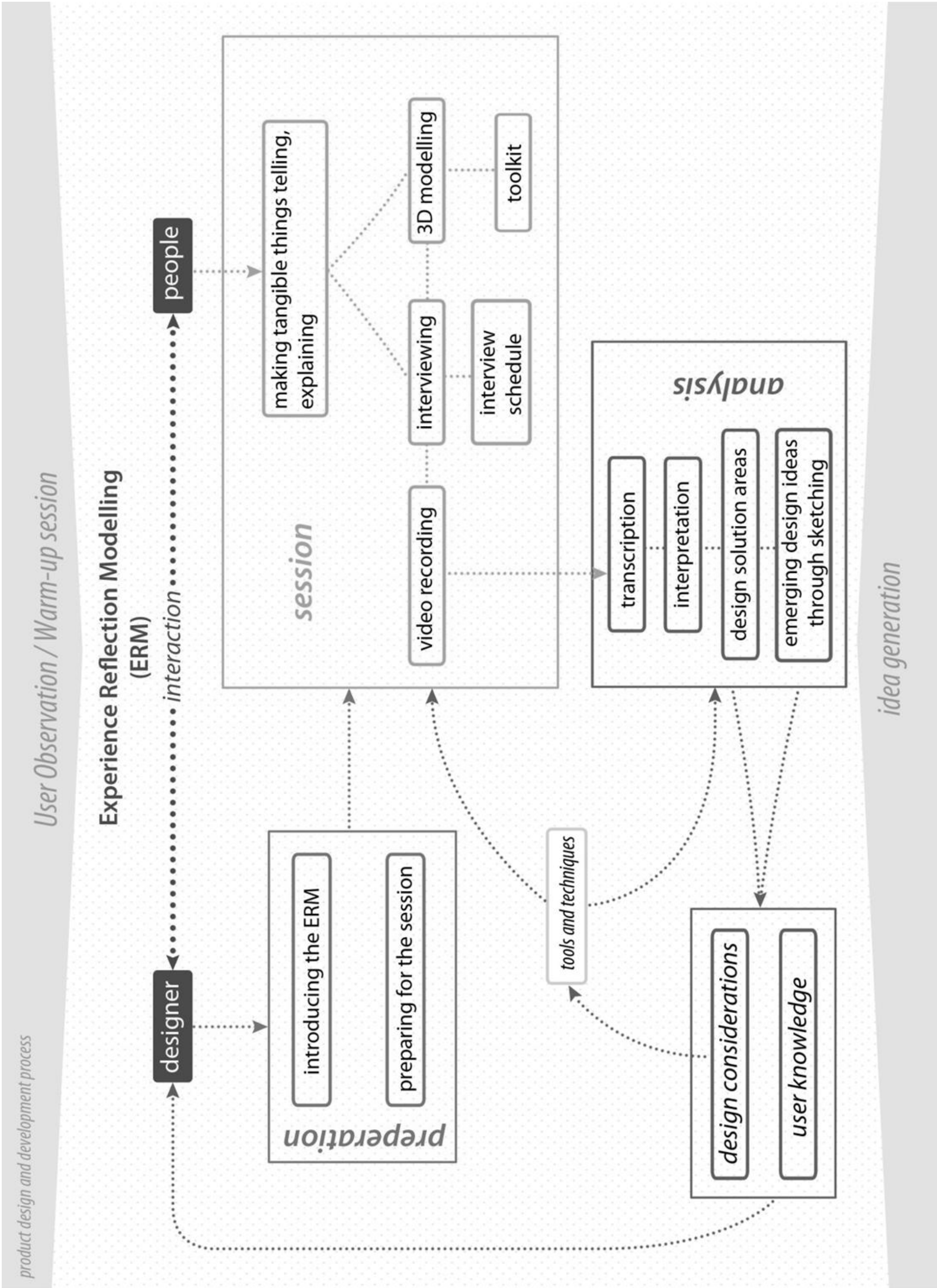


Figure 2.8 The ERM Method

Interviews are effective ways to gather qualitative data from participants about their thoughts and experiences related to a research topic (Clark, 2008). In the ERM, semi-structured interview technique with an interview schedule is used that involves questions about whole lifespan of a product. 3D modelling and interview techniques are conducted together, since they are brought together as complementary techniques. During the ERM session, the researcher asks questions to the participant about related product experiences and preferences by using the interview schedule provided. In response to that the participant expresses her/his thoughts (i.e. she/he “thinks aloud”) as she/he brings together the components of a product by using the toolkit provided. The session proceeds step by step with the responses to build up the 3D model of the participant.

Video recording is a qualitative research technique that has many advantages in analysis of data mainly focusing on the details of interaction and behaviour. It consists of moving images, with or without sound. It provides the researcher with many details by freezing, framing and slowing down the video. This helps the researcher to scrutinize different aspects of data (Gibson, 2008). Because of these advantages and presenting both textual and visual data at the same time, video recording is used to document and analyse the sessions in the ERM.

Analysis techniques in the ERM are used to break sessions into smaller parts to gain better comprehension about participants’ statements, and to synthesize findings based on project considerations. To this end, various techniques are used such as transcription, interpretation, sketching etc. The analysis enables students to make their own interpretations and conclusions through different abstraction levels. These include quotes/pictures, insights/conclusions from the raw data, emerging themes/potential design solution areas, clusters of themes, product directions/ideas (Sleeswijk Visser, 2009).

2.5.1 Locating the ERM on Design Research

Spectrum of design research has been investigated and defined by numerous researchers and practitioners (Frankel & Racine 2010; Fallman, 2008; Sanders, 2008; Hannington, 2003; Laurel, 2003; Cross, 1999; Roth, 1999; Archer, 1995; Frayling, 1993). In each one, dimensions of it are based on different aspects of research in terms of data collection, mind-set, purpose, tools and techniques, et cetera. To locate the ERM in this spectrum, the characteristics of the ERM, and the roles of participants and design researchers (both the tutors and the design students in this thesis) need to be clarified. The ERM in general aims to inspire and inform early stages of design and development process through generation of knowledge with participants. The participant as the actual user is the expert of her/his experiences (Sleeswijk Visser, et al., 2005). She/he reveals her/his own creativity through reflecting experiences, needs and preferences on a 3D model, and making changes on it by using the toolkit provided. The roles of design researchers are changing according to the phases of the ERM. In the preparation phase, it is to adapt the tools and techniques (e.g. interview schedule, toolkit, etc.) for the design project, and to arrange the sessions. In the session, it is to guide the participant for enabling to express and reflect her/his needs, preferences and expectation regarding a product or an experience. In the analysis phase, it is to comprehend and criticize the participant’s expressions and reflections to develop potential design solutions by using their design knowledge (i.e. expertise or skills acquired from design education and practice).

The ERM is a qualitative method because of the tools and techniques used to gather information (e.g. semi-structured interview, reflection through 3D modeling, etc.) and the way to analyse the findings (e.g. video analysis, interpretation, developing design solutions areas, etc.). It is domain-specific design research (Poggenpohl & Sato, 2009), since it seeks to discover user knowledge regarding a particular design project. The ERM can also be assessed according to the data collected, tools and techniques used, purpose and mind-set of the researcher.

Tools in research methods can also be categorized such as verbal and visual based on the data gathered during research (Laurel, 2003). The ERM collects both visual and verbal data for the analysis. While semi-structured interview is mainly used to gather verbal data from participants, 3D modelling is mainly used to complement verbal data with visual data about participants' statements.

Hannington (2003) classifies research methods as traditional, adapted and innovative. Traditional methods are focus groups, surveys, questionnaires, interviews that are driven from research-led perspective. Adapted methods are mainly used in human-centred research for design practice. These methods modify traditional methods to better meet the needs of design research. Some of the examples of these are observational research, ethnographic methods and HCI. On the other hand, the purpose of innovative methods is to uncover participants' needs and preferences through enhancing creativity in research process by involving design-based tools and participation. In the previous chapter, presented tools for generative research are the exemplary tools for innovative methods. At first glance, the ERM seems to be an adapted method since it acquires techniques such as interviewing from traditional methods. However, it mainly focuses on design-based and innovative tools such as 3D modelling from generative research approach. In other words, the ERM adapts traditional methods to enhance the purpose and the implementation of innovative methods.

Sanders (2008) proposes two dimensions to organize a map for design research. One of them is approaches, and the other is mind-set in design research. Research-led approach has a longer history than design-led approach, and it is driven by sociologists, psychologists, anthropologists and engineers. She locates generative design research on the design-led perspective, since tools and techniques used are inspired and informed by design thinking. The ERM stands on the design-led perspective because of the tools used in the ERM sessions and analysis. She defines two opposing mind-set such as expert and participatory. In the expert mind-set, researchers consider themselves as the experts who aim to design for people through referring people as the subject of design research. On the other hand, the participatory mind-set refers people as the experts in the domain of experience. Sanders locates generative design research on the participatory mind-set, since she acknowledges participants as active co-creators in co-creation process. Co-creation means collective creativity of both designers and participants in design and development process in which participants with a high level of passion and knowledge are co-designers. However, the ERM is in between the expert mind-set and the participatory mind-set, but closer to the participatory mind-set within the context of this map. It helps design researchers (i.e. design students in this thesis) to generate knowledge with participants rather than considering them as co-creators or co-designers. In addition to invaluable user knowledge, the ERM also enables design researchers to integrate their tacit knowledge into the ERM analysis phase (Figure 2.9).

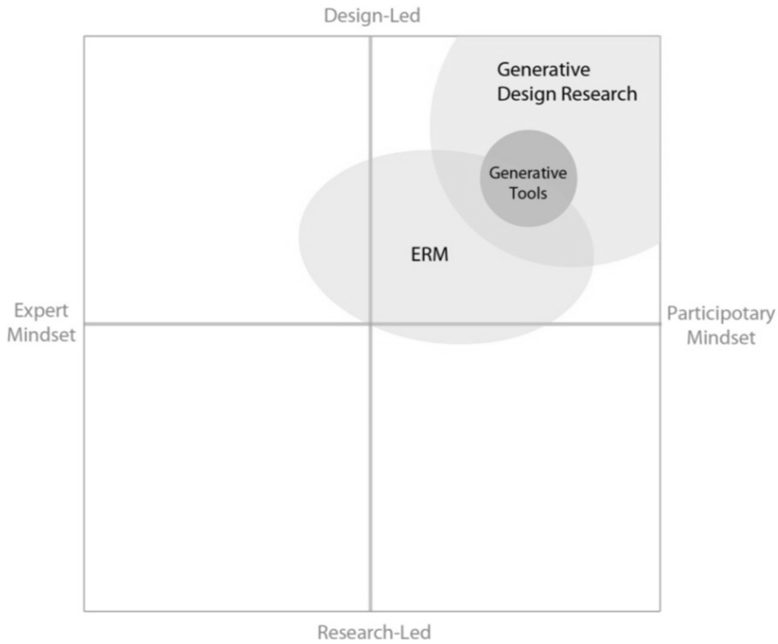


Figure 2.9 The ERM on map of design research (Adapted from Sanders, 2008)

2.5.2 Relating the ERM with Sustainable Design Considerations

Third year industrial design studio at METU that the ERM has been incorporated into has a main focus on sustainability. Thus, diverse sustainability considerations were incorporated into the design projects which were the design education cases of this doctoral study. The ERM method has been developed through these design education cases for sustainability. Concurrently, the tools used in the ERM method (i.e. interview schedule, analysis formats) were developed based on these sustainability considerations to enable the students to develop design solution areas based on these. Incorporating local values and usage patterns, encouraging product maintenance and product part replacement, understanding resource efficiency and consumption patterns focusing on user behaviours were the sustainable design considerations integrated into the design projects. These emphasize both technical and socio-cultural aspects of product lifespan. They were not only incorporated into the ERM phases, but also considered throughout all phases of the design process.

In response to current unsustainable practices of industrial production such as externalizing environmental and social impacts of product design, production, use as well as disposal, various approaches for sustainability aim to raise questions on contemporary issues related to design practice. With the emergence of sustainability, industrial design profession criticizes itself in terms of its impacts on environment, economy and society. Alternative practices have been searched to address and change unsustainable practices of industrial production. Those alternative practices should be evolved from a more empowering system rather than recurring existing one, and should be built on a new way of design thinking that integrates sustainability knowledge into early stages of product design and development process. Approaches in design for sustainability propose diversity in terms of their different understandings in achieving sustainable development and potential implications for design process. Although there are many approaches, none of them is adequate by themselves to fully understand sustainability. Many approaches can be integrated with each other in design process. However, in former approaches, sustainability in industrial design profession is mainly affected by engineering approaches (e.g. Life Cycle Analysis (White, et al., 2009; Crul & Diehl, 2006), Cradle to Cradle (McDonough & Braungart, 2002)) rather than "designerly way of thinking" (Cross, 2006). These earlier attempts are mainly based on later stages of design process such as product improvements, redesign, lifecycle assessments, material selection, user testing and product assessment, et cetera.

To integrate sustainability knowledge into early stages of product design and development process, design process itself has to be rethought. Design for sustainability is an approach that puts people and nature at the focus point through considering potential environmental, social and economic implications of a product's lifespan. People`s involvement in early stages of design process through generative research methods elicits tacit knowledge of people experiences, needs, preferences and expectations. Sustainability solutions would be well accepted and implemented if this knowledge informs early phases of design process.

2.5.2.1 Local Values, Usage Patterns and Rituals

Many approaches in sustainability have a main focus on environmental aspects (e.g. Cradle to Cradle (McDonough & Braungart, 2002); The Natural Step (Robért, et al., 2002), etc.), however, Papanek (1995) emphasizes the importance of both ethical and social considerations as they relate to product design profession. According to him, design should bridge human needs, culture and ecology to better address the impacts of products environmentally and socially. In many environmental approaches, the main focus is on consuming fewer resources, preserving for the future, and focusing on conservation and energy efficiency, however those would not be effective by themselves unless product designers link these considerations to social issues. Externalizing social aspects of sustainability, and mainly focusing on environmental and economic aspects in early approaches of sustainability resulted in a gap between solutions and people.

Involvement of people at early stages of design process is critical in terms of sustainability. Therefore, local knowledge and skills, and personalization of objects through integrating people into design process gain importance to enhance product diversity for various user needs and tastes (Walker, et al. 2009) and to develop design solutions for sustainability.

Within the context of the thesis, this consideration refers taking into account of local values and rituals that have the potential to enrich user experience and product user interaction, to promote product value, meaning and longevity, and to encourage product personalization.

2.5.2.2 Product Maintenance and Product Part Replacement

By reconsidering materials and components of a product, its lifespan can be extended through post-use scenarios in terms of maintenance, repair, reuse (Walker, 2010; Doğan, 2007; Cooper, 2005), and emotional attachment (Chapman 2009; Verbeek & Kockelkoren, 1998). Out-dated technological and design components of a product result in rapid product disposal in line with the changes in technology and trends (Walker, 2010). Additionally, inaccessibility of product parts or components may hinder product maintenance and repair as well as distance people from the products they use (Walker, 2006). From the point of this approach, through design intervention designers can make a significant contribution to existing objects that are less valued or discarded. Thus, obsolete objects may become useful and aesthetically appealing which is in accordance with economic, social and environmental aspects of sustainability (Marchand & Walker, 2007). Product maintenance, and product part replacement and upgradability are among the sustainable design considerations to prolong product lifespan.

In this thesis, this consideration includes ease of maintenance and cleaning, as well as refurbishing, replacing or renewing out-dated or worn-out parts technically or aesthetically, supporting product engagement and prolonging product life span.

2.5.2.3 Resource Efficiency and Consumption Patterns

Behavioural change aims to reduce the negative impacts of products that occur during use phase (e.g. energy and water consumption, etc.) by influencing users' behaviours through employing various strategies in product design process. Since these impacts are dependent on user behaviour, encouraging behavioural change is critical for reducing the negative environmental impacts of products. To this end, various strategies have been developed. For instance, two of these strategies are aiming at reducing energy use such as improving energy-efficiency of a product (i.e. reducing energy consumption by technological improvements) and enabling different use pattern of a product (i.e. behavioural strategies to reduce energy consumption) (Poortinga, et al., 2003). According to the behavioural change framework, improving energy efficiency of a product through technical interventions is not sufficient alone to reduce the impact of product use; instead a fundamental change in use should be initiated by products (Lilley, 2009; Lilley, et al., 2005).

In this thesis, understanding resource effectiveness and consumption patterns, raising awareness about them along with communicating the use of resources are important design considerations incorporated into the educational cases (Chapters 5, 6 and 7) to create more sustainable solutions and to encourage changes in user behaviour in line with responsible consumption patterns.

2.5.3 Features of the ERM

The ERM is proposed to have some characteristic features in terms of generative research, participants, product design and development process, students, and product lifespan. Throughout the study, exemplary cases selected from design education will be focused to describe the ERM by revisiting and assessing the features.

In terms of generative research. The ERM method helps people reveal their needs, expectations and preferences thoroughly through many special tools and techniques. It brings together different techniques and tools within the context of generative research. In this way, it enables people to tell, especially make tangible things and realize use context at the same time.

In terms of participants. 3D modelling toolkit facilitates participant to express his/her thoughts, feelings and desires that might be difficult to communicate through verbal techniques.

3D modelling technique that is composed of simple and abstract shapes helps the participant feel more comfortable in reflecting her/his experiences on the model while bringing it together, and explaining the 3D model through a think-aloud protocol, since the medium of constructing the 3D model is independent of participant's skills.

In terms of product design and development process. The ERM should be conducted before idea generation phase of design process because it generates knowledge that will inform idea generation. On the other hand, it should be used after user observations or generative warm-up sessions, since both the participant and the designer need to be familiar with the research topic of the ERM beforehand.

In terms of design students. The ERM enables a design research experience that enriches the interaction between design students and participants. It enables design students to understand user profile, use process and local values in relation with a product, and encourages design students to develop ideas by focusing on user experience. Conducting interview and 3D modelling simultaneously in the ERM sessions enables design students to match verbal data with visual one.

In terms of sustainability. The ERM is based on people involvement before idea generation phase of design process that supports the development of innovative sustainable solutions through a more participatory and bottom-up approach. The interview schedules used in the ERM sessions supports designers to access systematically the whole use phases of a related product in early stages of design process, since it involves the lifespan of a product by addressing the sustainable design considerations provided in the project briefs (Appendices F, I & Z).

In the next chapter, the methodology of this thesis will be explained; and in the following chapters, the implementation of the ERM in the educational cases at undergraduate level will be presented.

CHAPTER 3

METHODOLOGY

The doctoral study has evolved into many phases composed of comprehensive field studies. During this process, I took two different roles such as design educator as a member of the design studio team, and graduate design researcher acquiring knowledge and skills about research and design. There were many actors involved in and contributed to different stages of this study such as the studio tutors, the design students and actual users as the participants. In this chapter, my research approach, the field studies and the actors involved in these, data collection and analysis procedures in the subject of the dissertation will be explained.

Figure 3.1 illustrates the study process from the starting point to the conclusion. This process started with my intention to investigate the implications of user research for idea generation phase of design process. To this end, a preliminary study was conducted to explore how user observations would inform design dimensions, and how this information was integrated into idea generation phase of design process. The main motive behind this study was my observation on the gap between user research and idea generation phase in design process.

After this preliminary study, I started to scrutinize the literature about the approaches for design research and human-centred research, and their implications for design process. Participatory approaches and generative research became an inspirational starting point for me, since they would involve people in design process, and benefit from people's knowledge. Those approaches appeared to be more prominent, since they had the potential to bridge the gap between mental models of design students and users, and democratize design process through making it more open to diverse actors. However, a question appeared about the combination of generative tools and techniques, and their incorporation into design projects. Hence, the Experience Reflection Modelling (ERM) was developed as a design research method which brought together different tools and techniques through incorporating it into an educational project (Chapter 2). Firstly, the ERM was incorporated into an educational design project (i.e. My Sustainable Mini-oven) at undergraduate level in spring semester 2010. In this case, I mainly focused on the development of the ERM including the ERM brief, toolkit, interview schedule, and analysis formats (Chapter 5). The results of this research led changes on the ERM to develop it further that were based on my personal interpretations and observations, and also derived from the feedback and suggestions from the studio tutors. The changes on the ERM had an emphasis on the analysis phase of it. After the development of the ERM, it was incorporated into another educational design project (i.e. Making Tea as an Engaging Practice: Electrical Tea Maker with its Serving Set) in spring semester 2011. This time, the students' perspectives and insights were taken into consideration to gain feedback about pros and cons of the ERM method. This case included the most comprehensive field study of the doctoral study, since it covered different layers of data collecting procedures such as observations, individual and group interviews, and questionnaire. Based on the conclusions and findings from this field study, several improvements on the ERM were made to develop it further (Chapter 6). However, more feedback on these improvements was required to develop and propose the ERM guidelines for design education. To this end, the ERM was applied to an additional educational design project (i.e. Engaging and Sustainable Design Solutions for Tea Making and Serving Experience) in spring semester 2013 presented in Chapter 7.

The field studies were planned based on the findings and conclusions from each previous case. At the very beginning of the doctoral study, the rough outline of the methodology was visible, but the details in the primary research cases became clear during the research process. This was because of the exploratory nature of my research approach in this dissertation.

Figure 3.1 The research process in this thesis

3.1 Research Approach

Keywords for my research approach in this dissertation were qualitative research, triangulation, grounded theory framework and action research. My research adopted naturalistic rather than positivistic approach. Research in naturalistic approach differs from positivistic approach in terms of ontology, epistemology, axiology, generalizability and causality. It is socially conducted and depends on multiple realities in terms of ontology; knowledge is inseparable from the researcher in terms of epistemology, it is influenced by the values that the researcher has in terms of axiology, it cannot be generalized independently from the context in terms of generalizability, and cause and effect cannot be distinguished, hypnotized and measured in terms of causality (Lincoln & Guba, 1985). The doctoral study was based on mainly qualitative data. Field studies are the basis of the dissertation that will be explained in the following chapters.

Triangulation is "the combination of methodologies in the study of the same phenomenon" Denzin (1978, pp. 291). To enhance the rigour of the doctoral study, triangulation was used in different phases of the field studies. In this dissertation triangulation can refer two different types such as data triangulation and methodological triangulation (Robson, 2002; Denzin, 1988). Through data triangulation, observation, interviewing, questionnaire and memo writing techniques were used to collect data. Through methodological triangulation quantitative approach was used in some phases of the field studies to compare and assess the findings of qualitative approach.

Grounded theory provided an exploratory framework for data gathering and analysis throughout the cases selected for this doctoral study to develop the ERM method further. Since grounded theory is fed by not only the data but also the process in which the data is collected systematically during research (Glaser & Strauss, 1967), it is prominent for this thesis. Grounded theory approach is exploratory and emerging in its nature, initiated with data collection that can involve any kind of data - *all is data* - (Glaser & Holton, 2004; Glaser, 2002, 2001), and continue with comparing and contrasting incidents from data to form categories, and then developing relationships between categories to form patterns (Grbich, 2007; Stebbins 2001; Charmaz, 2000; Glaser & Strauss, 1967). Content analysis was used to develop relationships between emerging categories. Content analysis is an inductive method that is used for analysis of various kinds of data such as textual data from interviews, speeches, and visual data from photographs, drawings, video, et cetera to develop patterns and relationships between themes (Julien, 2008). Content analysis is based on the researcher’s interpretation of the data to develop categories and patterns. In this dissertation, research emerged through the joint process of data gathering and analysis. Accordingly, each case selected within the scope of the study was planned according to the analysis of the previous one, and the research questions were revisited in the studies to develop the ERM further. For instance, at the beginning of the first implementation of the ERM in an educational case (Chapter 5), the scope of the study wasn’t limited with undergraduate education of industrial design. After the conclusions of this case, I realized that students’ point of views about the ERM is critical for the further development of the ERM. And then, the research questions of the thesis were reshaped based on the integration of the ERM into design process in design education at undergraduate level, and student engagement during the ERM.

The ERM was developed through the cases selected from industrial design education. Using the implications of the ERM for design process within the scope of this dissertation presents similar features with *action research*. Archer defines action research as “systematic enquiry conducted through the medium of practical action; calculated to devise or test new, or newly imported, information, ideas, forms or procedures and generate communicable knowledge” (Archer, 1995, p.11). Action research is a practice-led and situation-specific research which allows exploration (Frankel & Racine, 2010; Archer 1995). Situation specific nature of action research might make the findings difficult to generalize, since they are dependent on the context of the action (i.e. research) takes place. However, by situation specific nature of action research, valuable insights will be produced through the conduct of further studies which aims to advance practice and to reach generalizable findings. Practice led nature of action research makes the researcher as an important actor since she intervenes in the process. Thus, researcher’s interventions, observations and judgements should be clearly explained in such studies (Archer 1995). Within the framework of this doctoral study, educational cases were selected from the third year industrial design studio projects. The researcher as one of the members of the studio team had the opportunity to get involved in the development of the projects’ briefs, design considerations of the projects, and to integrate, develop and implement the ERM method in the design process. The educational environment provided the researcher with the flexibility to implement that method. This appeared to be an advantage to further develop the ERM method.

3.2 Overview of the Study and Actors Involved In

As mentioned before, this doctoral study was based on undergraduate educational cases in the Department of Industrial Design at METU from 2010 to 2013. Starting from the preparation for the field studies to the analysis phase, many actors involved in these cases. Table 3.1 presents the actors and their active roles in this doctoral study. Overview of the doctoral study is presented in Table 3.2. List of the studio tutors and the design students involved in this thesis is presented in Appendix A.

Table 3.1 *Actors and their roles in this doctoral study*

		me as a graduate design researcher	**me as a tutor**	**studio tutors**	**design students**	**participants**
Preparation for the cases	Development of project brief		●	●		
	Development of ERM brief	●	●	●		
	Development of ERM interview schedule	●		●		
	Development of ERM toolkit & drawing file	●				
	Development of ERM analysis formats	●				
	Preparation of invitation letters	●				
	Preparation of thank you letters for participants	●				
	Development of ERM environment	●				
	Conducting pilot study for ERM sessions	●		●		
	Preparation of ERM presentation		●			
ERM Phase	Preparation of ERM toolkit				●	
	Recruiting participants for ERM sessions				●	
	Arrangement of ERM environment				●	
	Conducting ERM sessions				●	●
	Conducting ERM analysis				●	
Data collection & Analysis	Planning data collection procedure	●				
	Observations	●	●			
	Interviews	●			●	●
	Questionnaire	●			●	
	Taking memos	●	●			
	Analysis of field researches	●				
	Presenting the findings	●				

In this process, I took different roles such as graduate design researcher and tutor at different stages of the doctoral study. These roles overlapped in many stages of the study, and both informed each other and enriched the research process.

The design projects as the prelimary and primary research cases were developed by the tutors of the third year design studio (i.e. ID 301 and ID 302). The sustainable considerations integrated into the ERM method were defined prior to the development of the ERM brief. Before the field studies, many stages were developed such as ERM brief, toolkit, interview schedule, analysis formats. During the development of those, I also got feedback from and suggestions of the studio team members and my colleagues. Invitation letters including consent form and brief description of the ERM, and thank you letters for the participants involved in the sessions were prepared. For the preparation of the ERM environment, and the development of the interview schedule and analysis format, I also benefitted from knowledge and skills acquired from my previous design researcher experiences. Since these phases involved visual elements, and needed design knowledge, I used my designer skills for the development of the toolkit and the drawing file, the ERM analysis format, and the invitation letters.

Before finalizing the ERM interview schedule and the toolkit, I conducted pilot ERM sessions to assess the ERM sessions and developed the interview schedule and the toolkit further prior to the first and second field studies. In these pilot sessions, some of my colleagues helped me for the documentation.

For the preparation of the ERM presentation which introduced the method to the students, as part of the studio team, I put my tutor identity in front to help the students better understand the ERM phases.

During the ERM phases, the design students were responsible for conducting the method. They adopted the role of a design researcher, and proceeded the phases of the ERM by themselves by the guidance of the studio tutors.

As a graduate design researcher, I was also responsible for the development of the field studies including data collection procedure and tools, and analysis and presentation of the data. In this process, I used knowledge and skills acquired from my researcher identity. Designer knowledge and skills had an impact to a greater extent on planning, conducting and presenting these field studies.

Table 3.2 *Overview of the researches conducted within the scope of the doctoral study*

	Name of the design project	Questions	Method	Motive	Topic of case	Design considerations
Preliminary study	*Transcending Products: Glass Packaging with Double Life (2010 Fall) (Turhan & Dogan, 2011)*	How can user observations inform design dimensions and design solutions, and how is this information integrated into idea generation phase of design process?	pre-analysis of initial design concepts for sampling in-depth interviews with 10 students who were inspired by user observations online survey conducted with 27 out of 36 students	exploring the gap between the user observations and idea generation	food and beverage packaging	use and post-use product lifespan
Case I	*My Sustainable Mini Oven (2011 Spring) (Turhan, et al, 2011; Turhan & Dogan, 2012)*	How can the ERM method be integrated into product design and development process? How can sustainable design considerations be integrated into the ERM? What is the sequence of the ERM in product design and development process?	development of the ERM including ERM brief, toolkit, interview schedule, analysis sheet observations	initial implications of the ERM	mini oven	product maintenance and repair, engaging design solutions, energy efficiency and consumption
Case II	*Making Tea as an Engaging Practice: Electrical Tea Maker with its Serving Set (2012 Spring)*	How can the ERM be integrated into another product design process in design education at undergraduate level? How can the ERM enrich engagement between novice designers and tasks during generative research phase of design process? Which techniques and tools can be incorporated into the ERM to develop it further? What are the implications of the ERM method for design process (particularly at idea generation phase)?	development of the ERM brief, toolkit, interview schedule, analysis format pilot study for the ERM session observations individual interviews with students interviews with participants group interviews with students questionnaire with students	further exploration of the ERM understanding what participants and students think about the ERM further investigation of analysis techniques for the ERM	electric tea maker and its serving set	incorporating local values, usage patterns and rituals, encouraging product maintenance and product part replacement, understanding resource consumption patterns and communicating the process of tea making
Case III	*Engaging and Sustainable Design Solutions for Tea Making and Serving Experience (2013 Spring)*	Which techniques and tools can be incorporated into the ERM to develop it further? What are the impacts of the changes in the ERM method on student engagement?	development of the ERM brief, toolkit, interview schedule, analysis format observations group interviews with students questionnaire with students	gaining feedback about the changes of the ERM further investigation of analysis techniques for the ERM	electric tea maker and service accessories	incorporating local values, usage patterns and rituals, encouraging product maintenance and product part replacement, understanding resource consumption patterns and communicating the process of tea making

3.3 Data Collection

In this doctoral study, writing notes (i.e. memos), observations, interviews and questionnaires were used to collect data for the development of the ERM method.

Writing Memo. I had been taking notes about the discussions with my supervisor, my observations, reflections and interpretations on the educational cases since 2009. These memos were recorded in personal notebooks (Figure 3.2). Memo writing helped me explore, explain, and interpret the data through sorting and analysing it, and developing ideas about the research (Charmaz, 2006, Bryant & Charmaz, 2007).

Figure 3.2 Personal notebooks during the entire doctoral study

As this doctoral study was comprehensive and multi-faceted, the content of the personal notebooks also enabled me to remember and track the ongoing study process, and to develop the research plan without missing any phase.

Observations. Throughout the doctoral study, personal observations were made and these were recorded at the notebooks. They were also photographed and video recorded during the phases of the ERM. On the other hand, more structured observations were conducted to gather more data during the ERM sessions and reduce personal bias on reporting. Observations enables the researcher to understand what people actually do rather than what they say (Gillham, 2008; Robson, 2002). Therefore, the structured observations as a complementary data collection technique enabled me to support the findings from the interviews that I conducted with the students.

Figure 3.3 A scene from the structured observations

In this doctoral study, structured observations were conducted at the ERM session phase of the second (Chapter 6) and the third (Chapter 7) field studies. The observations were made at the observation room of UTEST (Figure 3.3). The observations of the second field study were made at 16 – 17 March 2012, and the observations of the third field study were made at 7 – 8 March 2013 concurrent with the ERM sessions. Each ERM sessions lasted approximately one hour, and there were 13 ERM sessions in total (i.e. seven sessions in the second case, and six in the third case).

A checklist was developed for the observations in line with the items in the group interviews conducted with the student teams during the second case (Appendix K). The important and critical issues noticed during the observations also helped me elaborate on these during the interviews with the students. Table 3.3 presents the association of the items included in the checklist and the group interview schedule. This checklist was also used for the third primary case of this thesis.

Table 3.3 *Comparison between the items in the observation checklist and topics in the group interviews*

Items in the observation checklist for the sessions (for the case II & III)	**Main topics in the group interviews (for the case II)**
	Presentation of the pilot study
	Rehearsing the ERM interview schedule
	Inviting the participant
ERM Environment	Arranging the environment for the ERM session
Equipment for documentation	Documentation
ERM toolkit	Preparation of the ERM toolkit
Welcoming the participant and starting the session Communication with the participant	Communication with the participant
Asking the questions	Asking the questions
Helping for the modelling process	Helping for the modelling process
Collaboration in the team	*It was asked during the individual interviews*
Documentation	Documentation
Ending the session	Communication with the participant
Other observations	
	Relationship between the interview schedule and toolkit

Interviews. Interviewing is one of the most common techniques in qualitative research, since it can be conducted easily with low cost (e.g. equipment used) and provides rich information about a particular topic (Cook, 2008). Semi-structured interviews enabling the participant to respond in a more flexible order with the guidance of an interview schedule were the main data collection technique employed in this study. They were conducted at many stages of the study (Figure 3.4).

During the individual interviews at the preliminary study and the Case II, pictures of the projects phases and students' posters (i.e. ERM posters and idea generation exercise posters) were showed to remind the process and enabled the students to exemplify their arguments.

Preliminary study — Individual

Exploring the implications of user observations for the idea generation phase

10 students from the 3rd year industrial design

14 Dec. 2010 – 6 Jan. 2011, ≈ 23 minutes, Faculty of Architecture, room: 424

Case II

Group

Exploring students' opinions and suggestions on ERM preparation and session phases

7 student teams from the 3rd year industrial design studio

16 – 17 March 2012, ≈ 30 minutes, Faculty of Architecture, UTEST

Individual

Exploring participants opinions about ERM sessions

7 participants involved in the ERM sessions

16 – 17 March 2012, ≈ 5 minutes, Faculty of Architecture, UTEST

Individual

Exploring students' opinions and suggestions on ERM phases

33 students from the 3rd year industrial design studio

5 – 25 April 2012, 20 – 60 minutes, Faculty of Architecture, room: 68

Case III — Individual

Exploring students' insights into and suggestions for the major changes of the ERM

6 student teams from 3rd year industrial design at METU

29 March 2013, ≈ 35 minutes, Faculty of Architecture, room: 207

Figure 3.4 Interviews conducted at different stages of the doctoral study

A pre-analysis of initial design concept of the students were made for sampling of the interviews at the preliminary study. Ten students were selected who were inspired by the user observations at the idea generation phase. The interview schedule used in the preliminary study (Appendix C) composed of three questions; however I prompted the design students in between the responses to gain more in-depth information. The questions were designed to understand the level of inspiration from the user observations and its implications for the idea generation phase.

In the second case, both group and individual interviews were conducted at different stages. The first one was group interviews to gather information about the students' opinions and suggestions on the ERM preparation and session phases. These group interviews were conducted right after each ERM session that appeared to be the best schedule in terms of recalling the session in detail. The group interviews were conducted because of the time limitation between the teams' ERM sessions. The interview schedule of the group interviews consisted of several questions regarding the phases and sub-phases of the ERM preparation and session (Table 3.3). In the group interviews, some students were remained less proactive than others. Due to this limitation of the group interviews, the individual interviews were conducted to gain more detailed information from the design students. The timing of the individual interviews were after the ERM and the idea generation exercise (i.e. Matrix) of the second case. The interview schedule of this one composed of several questions about all ERM phases, implications of the ERM outcomes for the idea generation phase, and the students' intention to use the ERM in the future (Table 3.4). On the left side of Table 3.4, the main topic in the group and individual interviews conducted in the second case are presented sequentially. The assessments of the ERM phases, suggestions for the further development of these, and difficulties that the students faced with during these phases were asked separately for each main topic during the interviews (Appendices J & M).

Table 3.4 *Comparison of the topics in the interviews conducted during the second and third cases*

	Main topics in the group and individual interviews conducted in the Case II	**Main topics in the group interviews conducted in the Case III**
Preparation	Presentation of the pilot study	
	Rehearsing the ERM interview schedule	Assessment of rehearsal for the ERM session (i.e. dedicated time, clarity, benefits)
		Assessment of the interview schedule
		Assessment of giving information to the participant before the session
	Preparation of the ERM toolkit	Assessment of the drawing file and allocated time for the toolkit preparation
	Arranging the environment for the ERM session	
	Inviting the participant	
ERM session	Communication with the participant	
	Asking the questions	
	Help for the modelling process	
	Documentation	
	Relationship between the interview schedule and toolkit	
	Main topics in the individual interviews	

Table 3.4 *Comparison of the topics in the interviews conducted during the second and third cases (Continued)*

	Main topics in the group and individual interviews conducted in the Case II	**Main topics in the group interviews conducted in the Case III**
ERM analysis	Preparation of the first poster	Assessment of the first part of the ERM analysis (i.e. clarity in the preparation of the video presentation, length of video clips, content of the video presentations, watching other teams' video presentations)
	Transcription Insights Potential design solution areas	The level of influence of the other teams video presentations, insights and DSAs during the ERM analysis
	Relating verbal with visual	
	Preparation of the second poster	Assessment of allocated time for the second part of the analysis
	Categorization	
	Relating verbal data with visual one	
		Assessment of exchanging ideas with other teams during the ERM analysis
	Presentation	Assessment of presenting the video presentations and ERM posters, and its influence on the idea generation phase
Assessment of the ERM	Benefits of the ERM	
	Implications for the idea generation	Assessment of the implications for the idea generation
	Adaptation into another project and intention to use the ERM in the future	
	Differences and similarities between the ERM and prior design research experiences	
	Division of labour	
		Assessment of giving technical information about the product before the ERM

In the second case, interviews with the participants were also conducted after the ERM sessions to gain their opinions about the session experience. The participants were positive towards the questions about the sessions. The limitation of these interviews was the positive attitude of the participants towards the students. Almost all of them were the relatives or the friends of the students, so they might hesitate to express their opitions objectively. The information gathered from them were limited, therefore they weren't analysed separately. Instead, they were used as complementary information for some of the interpretations about the ERM sessions.

Within the context of the third case, the group interviews were conducted after the questionnaire, because the answers of the students in the questionnaire might be affected with the responses of other team member at the group interviews. In the group interviews, the questions were asked according to the findings of the questionnaire results. The content of the questions mainly included the major changes on the ERM developed based on the finding of the second field study (Appendix X). The right side of Table 3.4 also presents the main topics in the group interviews conducted during the third case.

Surveys and Questionnaires. An online survey for the preliminary study was delivered via METU online to the students after the interviews with ten students. The purpose of this survey was to explore the rest of the design students' opinions about the implications of user observations focusing on post-use examples for the idea generation phase. There were three open-ended questions in the survey, and 27 out of 36 students replied the questions.

A questionnaire was developed based on the findings from and insights into the interviews conducted at the second case. It was aimed to support the interpretation of the findings from the qualitative research part. After the analysis of the qualitative part, numarious items were developed based on the findings presented in Tables 6.1, 6.2, 6.3 and 6.4 in Chapter 6. These items were revised several times, and limited to 61 items. The questionnaire was composed of two parts (Appendix N). In the first part, brief information about the ERM phases with corresponding images was provided to remind the students the process. In the second part, there were items on a five point Likert Scale. The topics in the questionnaire were about the issues affecting the engagement of the students during the ERM:

- clarity and relevance
- workload and allocated time
- professionalism and collaboration
- active involvement of the participant
- integration of personal skills and knowledge
- effective sharing
- comprehension and idea generation

The main limitation was the time period between the implementation of the ERM and the conducting the interview. It was held at 15th of February 2013 when the students enrolled in the fourth year of industrial design program. Thus, a brief explanation about the ERM process was given to the students verbally before handing out the questionnaire sheets. Thirty two students filled out the questionnaire out of 33. Twenty two of them were reached at the design studio, and ten of them were reached via e-mail.

For the third case of the doctoral study, the questionnaire for the second case was modified and revised according to the changes on the ERM method. After the ERM ended in third case, it was handed out 28 students out of 29 attending the studio at 19th of March, 2013. The aim of this questionnaire was to evaluate the major changes of the ERM method. There were 59 items in this questionnaire. The items were similar to the previous questionnaire, however, some items related to presentation, first part of the analysis and presentation of the findings, sharing, and technical knowledge provided were revised. New items were added about sharing and video presentations for the first part of the ERM analysis based on the changes on the ERM (Appendix T). Some items in the previous questionnaire were excluded which were irrelevant to this implementation of the ERM. The details of the questionnaires conducted at the second and third case will be explained in the Chapter 6 and 7. The common limitation of the questionnaire was the students' tendency not to check extreme responses such as strongly agree or disagree.

3.4 Analysis Procedure

Each field study on the doctoral study was developed according to the research questions defined (Table 3.2). Due to the diversity of the raw data gathered, the analysis designs were different from each other for each field study. The analysis of the entire study composed of mainly qualitative analysis, and complementary quantitative analysis.

3.4.1 Analysis of the Preliminary Study

Analysis of for the preliminary study, voice recordings of the interviews were verbatim-transcribed and were analysed based on the students' design solutions. The implications of user observations for the design solutions were explored, and emerging project dimensions were retrieved from the data by content analysis. All survey replies were brought together in an Office Word document, and the responses were categorized based on the benefits of the user observations and the implications of it for the idea generation. For the implications, the data were related with the corresponding images of the concepts that the students exemplified during the research.

3.4.2 Analysis of the First and Second Field Studies

For the first field study, interpretations were made on the personal observations and drew conclusions based on these interpretations. In the second field study, the analysis was composed of both qualitative and quantitative parts. The qualitative analysis was multi-faceted which was composed of very comprehensive data to be organized and analysed. The analysis procedure was developed by using different tools and techniques such as content analysis, and using software for analysis, interrelationship diagramming, etc. (Figure 3.5). The main considerations in the development of the analysis procedure were research questions, enabling interpretations of the data for developing themes, keeping the information of the data without losing the connections from the real sources, relating the verbal data with the visual data, and enabling interpretations and inferring relations between the themes.

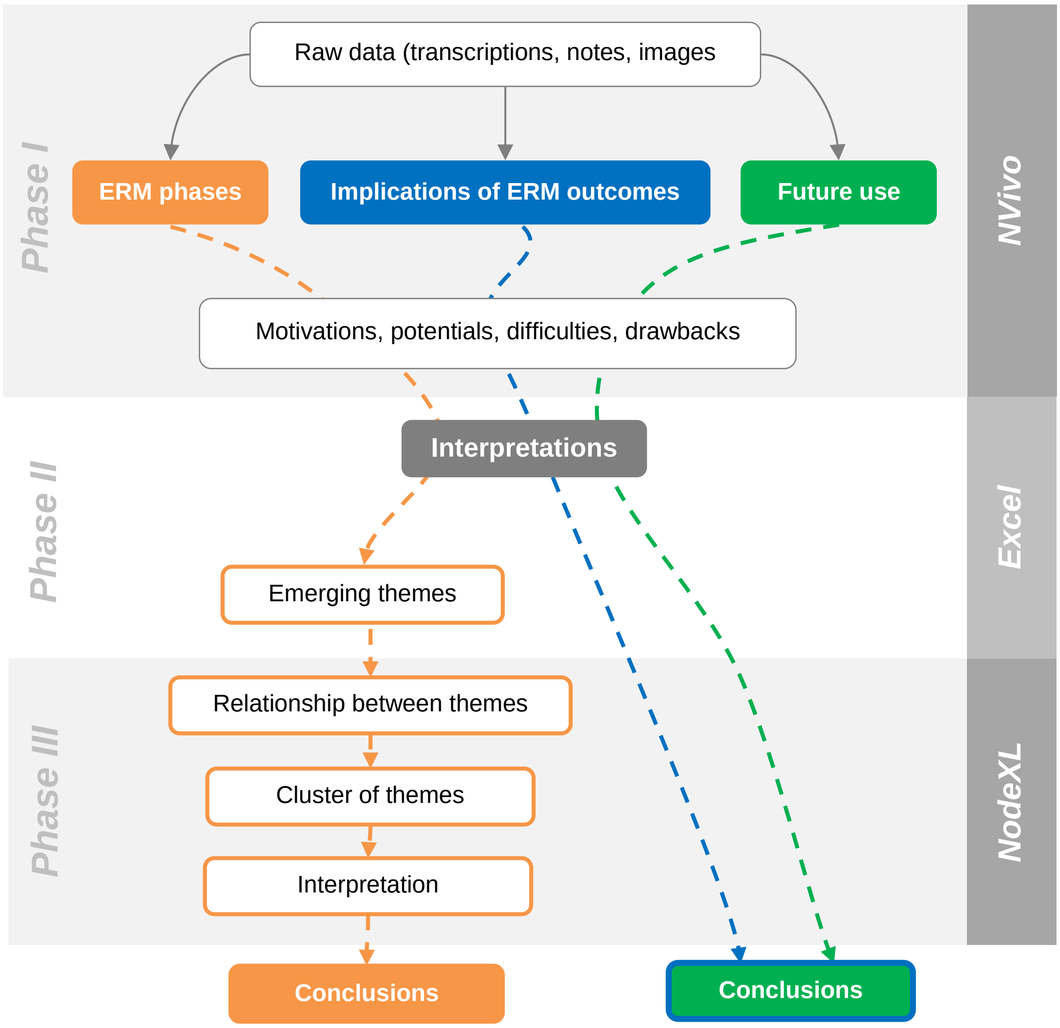


Figure 3.5 Analysis of qualitative part of the second field study

Phase 1. At first, the interviews were verbatim transcribed student by student and team by team. Then, raw data was brought together under the student team folders. Each student team folder comprised of the transcriptions of individual and group interviews, pictures of the team's works produced during the ERM and the idea generation exercise, notes recorded on the checklists during the observations. Then, these documents were imported into a qualitative analysis software namely NVivo (Figure 3.6).

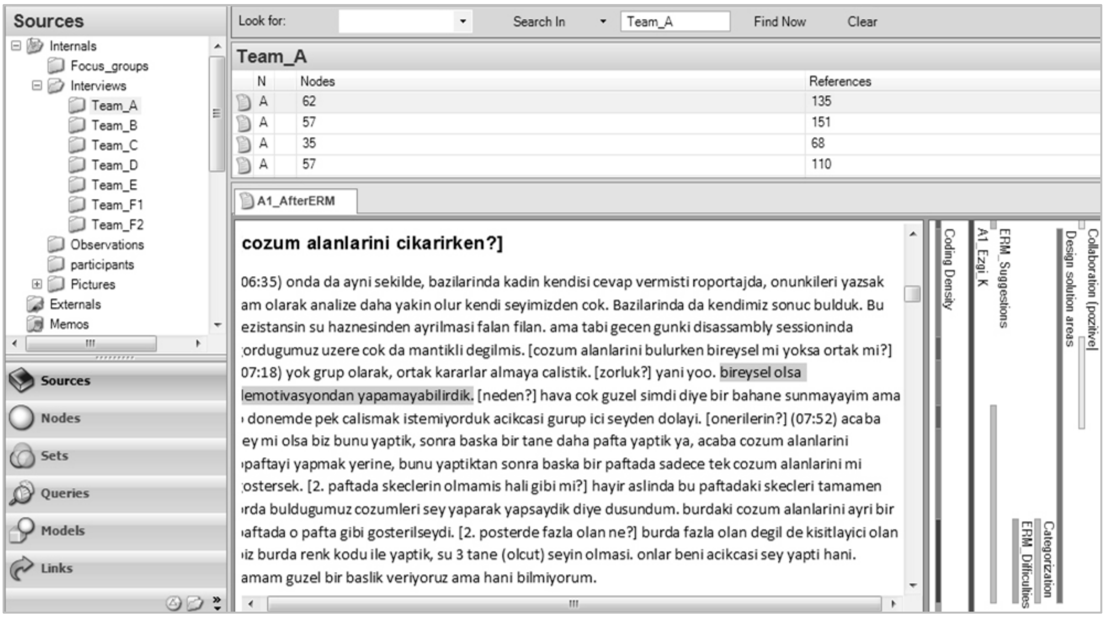


Figure 3.6 An NVivo document bringing together the raw data

The data was coded based on three main groups such as the ERM phases, the implications of the ERM for idea generation, and the students' intention to use the ERM in the future. After then, coded data was re-coded according to the motivations and difficulties regarding the responses of the students and the observations.

Phase II. After the first phase, the data was exported to Office Excel documents team by team. There were hundreds of documents including the data (i.e. transcriptions, notes and pictures) categorized according to the difficulties and motivations of the corresponding group (i.e. phases of the ERM, idea generation, future intention). I gained insights through interpreting the categorised data. After the interpretations, the analysis divided into two (Figure 3.5). The interpretations of the implications of the ERM outcomes for the idea generation phase and the students' intention to use the ERM were presented based on the coded data. The analysis about the phases of the ERM was continued through developing themes from the interpretations. These themes included the factors affecting student engagement in the ERM method. Based on the students's statements, these themes were related to the ERM phases. For instance, a student from Team C in the second primary case responded the question about general assessment of the ERM method as presented in Table 3.5.

Table 3.5 *An example of gaining insight and developing themes based on a student's statement*

Statement	Interpretation	Themes
"…the ERM is beneficial for the design students in terms of proposing and defining problem and design areas, and developing design solutions based on these. Because, we start with an actual user. We step out of our mind sets. We are developing ideas based on the user's problems, preferences, opinions, and synthesizing our opinions and knowledge with these. Thus, sketching phase was very beneficial for me…"	The student found the ERM beneficial because of having the chance to integrate user knowledge into her/his design knowledge during the sketching phase.	Sketching – integration of personal knowledge

In these statements, the student highlighted her/his motivation in the sketching phase. I considered this motivation as *integration of personal knowledge*. Furthermore, there was a relationship between sketching and integration of personal knowledge.

Another example about how I have retrieved the themes included the factors affecting student engagement in the ERM method is presented below (Table 3.6). In this case, another student from the same team responded a question about her/his preferences of having more information about the ERM phases.

Table 3.6 *Another example of gaining insight and developing themes based on a student's statement*

Statement	Interpretation	Themes
"…at the beginning of the process, before you have made a presentation at Kubbealtı, I don't have any idea about the ERM method. But the presentation clearly explained the ERM method with its phases. Provided examples supported these visually. If we have any question in our minds about what to do, we read the brief. Yet, the presentation was explanatory since it includes the phases, your pilot study, sample posters, examples from the session…"	Presenting the ERM method along with the examples and formats at the beginning of the process enabled the student to understand the ERM thoroughly.	introducing the ERM - presentation presentation - formats provided presentation - sample videos introducing the ERM - clarity

In these statements, the student explained why she/he found the ERM method clear through providing examples. Based on these, there was a relationship between introducing the ERM phase, ERM presentation, formats provided, and sample videos. These are also related to *clarity* as a theme affecting the student's motivation during the introduction of the ERM method.

After interpreting the student's statements and developing the themes, I compiled all findings of all teams under two Office Excel files. These files included the motivations and difficulties that the students faced with during each ERM phase along with the corresponding themes. Similar difficulties or motivations were brought together in Excel files. Then, they were re-interpreted to eliminate repetitions. The revised versions of these tables are presented in Chapter 6. Concurrently, the sub-themes and the relationships between them that were retrieved from the interpretations were grouped under main themes. For instance, there were many sub-themes such as *diversity in forms*, *diversity in volumes*, *diversity in parts*, *materials in toolkit*, *parts in toolkit*, *defined parts* and *simple parts*. These were all related to the diversity of forms and materials in the ERM toolkit. Thus, these sub-themes were categories under the *diversity in toolkit* theme. Another example was clarity. Within the context of this study, clarity meant to what extent the phases, definitions, and tasks were clear for the students. The sub-themes related to *clarity* were *defined process*, *sequence of process*, *focused process*, *defined categories*. These groupings were conducted for all of the sub-themes. Then, the main themes for the motivations and the difficulties of each team were presented along with the corresponding interpretations at the tables in Chapter 6.

Phase 3. At the tables presented in Chapter 6, understanding the relationship between the themes (i.e. factors affecting student engagement) and the ERM phases was possible, but it was difficult to see the interrelations between other themes. For instance, in Table 3.7, there was a relationship between *clarity* and *introducting the ERM*, but to see other themes and the ERM phases related to clarity, I needed to visualize these revised tables presenting the interpreted data based on the student teams. To build interrelations visually between these, the relationships between the main themes were exported to an Office Excel plugin namely NodeXL. The plugin helped me to review the overall picture of the factors affecting student engagement in the ERM, and to see the level of strength between the relationships, and the frequencies of the themes in the data. Two NodeXL files were created based on difficulties and motivations during the ERM phases. In these diagrams size of the circles are representing the frequency of the themes stated by the students; and thickness of the lines between the cirles are representing the frequency of the relationship between the themes. The revised interrelation diagrams are presented in Chapter 6 (Figure 3.7).

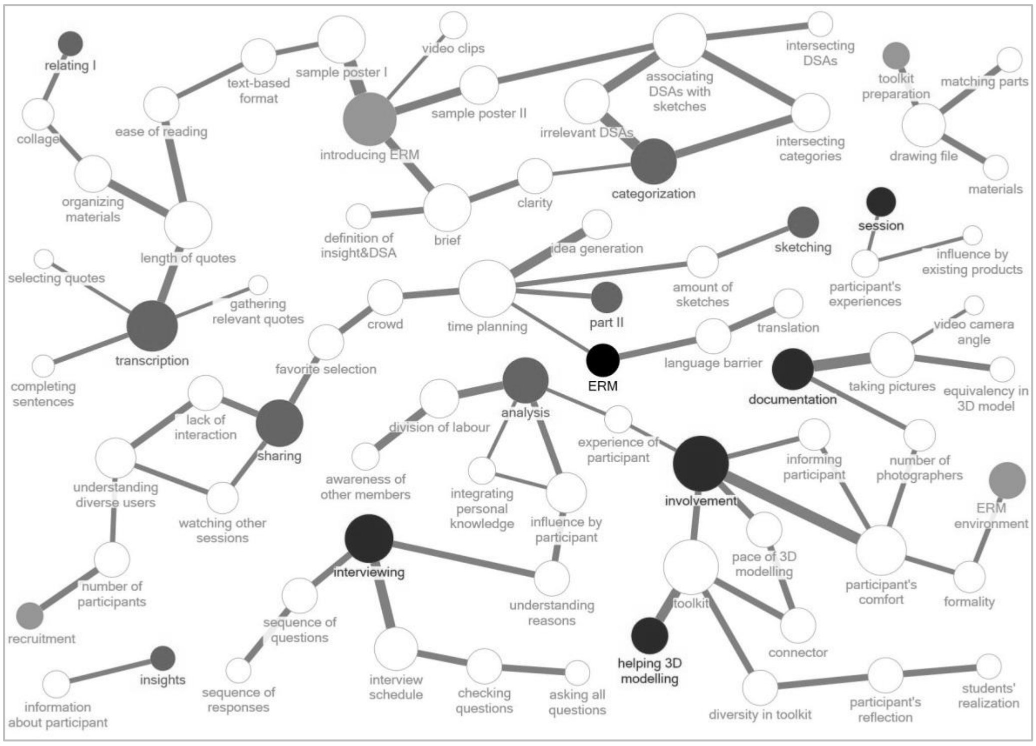


Figure 3.7 The interrelation diagram for the difficulties in the ERM

The analysis of the qualitative part of the second field study was an iterative process rather than linear. I revised the interpretations and wording of the themes, and repeated the categorization of the themes several times. In any phase of the analysis, I needed to return to the previous phase to make sure that the results were comprehensible.

The questionnaire used as a complimentary data collection tool in the second field study was analysed by using a software programme namely SPSS Statics 20. A reliability test (i.e. Cronbach Alpha) was conducted; and then central tendencies (i.e. mean, median, mode) of the data were analysed. The interpretation of the quantitative data was made by using central tendencies and comparing the results with the qualitative ones of the research.

Looking back to the interpretations on both qualitative and quantitative parts, and the relationships between the emerging themes, I reinterpreted the data in a holistic way and drew conclusions about the suggestions to develop the ERM further.

3.4.3 Analysis of the Third Field Study

The interviews used in the third field study was analysed by using the same technique used for the second case. The qualitative part of this research was focused on the major changes that were developed based on the findings of the previous field study. The interviews were transcribed and grouped under the changes of the ERM method. Then, the interpretations were made team by team. Finally, I drew conclusions considering the results of the questionnaires and the group interviews.

The conclusions of this study are based on specific educational cases. Because of the nature of design research, they are dependent on time, and respondents' and researcher's background. The conclusions of the researches are limited with my interpretations. The details of data collection and analysis procedures will be clarified in the chapters presenting the field studies in detail (Chapter 5, 6, 7). The following chapter presents the preliminary study that helped the researcher better identify the area of research.

CHAPTER 4

PRELIMINARY STUDY: THE IMPLICATIONS OF USER OBSERVATIONS FOR PRODUCT DESIGN SOLUTIONS

Through this preliminary study, the relationship between user observations and idea generation phase was explored. As the result of this study, the researcher defined the problem statement, and searched alternative and innovative generative tools and techniques to enable design students to better understand people’s needs preferences and expectations regarding a product, and to better incorporate user knowledge into idea generation phases.

This study particularly emphasises the early stages (i.e. user observations and idea generation phases) of a third-year industrial design project which has been developed and undertaken at undergraduate level in the Department of Industrial Design, at METU in collaboration with a major glass packaging producer (i.e. Anadolu Cam A.S.) (Appendix B). The Project aimed to have a better understanding of local knowledge and to integrate post-use design considerations into the idea generation phase of design (Appendix B). This chapter presents initial conclusions for and insights into the student projects with a focus on glass packaging solutions with double life to illustrate the implications of the user observations for encouraging and integrating post-use design solutions at the idea generation phase of the design process.

The purpose of this project was to develop design solutions presenting potentials of post-use design thinking in the area of glass packaging for food and beverages. The project focused on both the use and the post use phases of product lifespan, which also emphasized on the transformation of mass-produced glass packaging into promotional products (i.e. water bottles, candle jars and bathroom accessories) through integrating locally produced parts and/or surface finishing applications. The phases of this project included literature search, user observations, idea generation exercises (divergence), preliminary jury (convergence), presenting design details and final design solutions.

The main goal of this preliminary study was to explore how user observations informed post-use dimensions and design concepts, and how that information was incorporated into the idea generation phase of the design process. To this end, the implications of the user observations for the post-use design concepts were analysed and presented within the scope of this study. Throughout the study, a set of pre-analysis, in-depth interviews and an online survey were conducted sequentially as demonstrated in the diagram below (Figure 4.1).

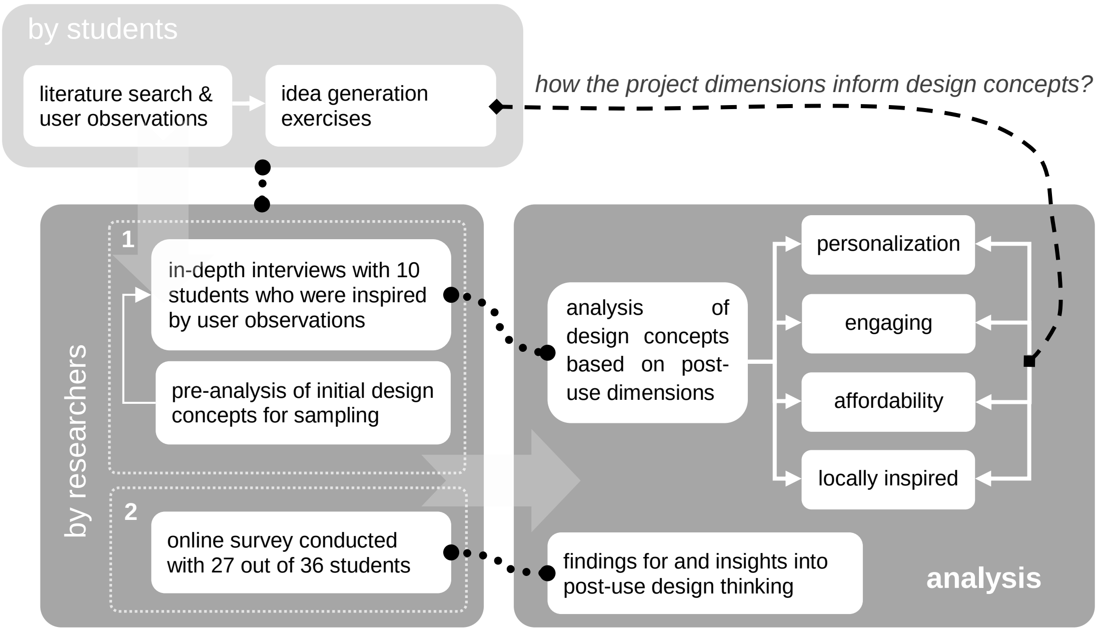


Figure 4.1 The methodology of the preliminary study

During the user observations, the students visited several homes and they documented the types of glass packaging being re-used, various applications on glass packaging for re-use, and functional and decorative qualities of re-used products within their context.

Upon the completion of the user observations and the literature search phases, the students generated several design concepts through an idea generation exercise, namely Matrix (Korkut & Dogan, 2010). This exercise was the primary tool for the initial and emerging post-use design concepts. It helped the students develop diverse design concepts for both the use and post-use phases. Each student developed at least three design concepts individually and three additional ones in group leading to over two hundred initial design solutions. For the aim of this study, the design concepts developed by the students were firstly examined, and then compared with the results and visual recordings from the user observations phase. After this analysis, ten out of 37 students were recruited for in-depth interviews, considering that at least one of the design concepts, which was developed by these selected students, were directly informed and influenced by the user observations. The exemplary cases presented here constitute a small portion of the whole design concepts for both the use and post-use phases developed by all 37 students (Table 4.2).

The data from the interviews were analysed thoroughly concept by concept, and then were categorized considering the implications of the user observations and recordings for the design concepts in terms of post-use and re-use. Emerging definitions of dimensions for the post-use design concepts such as personalization, engaging, local, etc. were retrieved from the responses of the students, and how those dimensions informed the initial post-use concepts were analysed.

Upon the completion of the in-depth interviews, an open-ended survey was conducted among the whole third-year design students via METU online. The responses of the students were analysed considering the contribution of the user observations to the idea generation phase.

4.1 Findings and Discussion

This section presents the findings and discussions of in-depth interviews and online survey consequently.

4.1.1 In-Depth Interviews

During the in-depth interviews, to understand how the user observations inspired the idea generation phase and informed the post-use dimensions, the students were shown visual recordings from the user observations and were asked about

- the inspiring post-use examples gathered during the user observations,
- how each concept emerged during the idea generation phase and what the inspirations were,
- to what extent user observations informed and inspired the emerging design concepts (Appendix C).

According to the findings from the in-depth interviews, the design concepts were categorized as shown in Table 4.1. During this analysis, it was found difficult to determine whether a design concept was completely inspired from the user observations. Visual recordings from the students' design concepts and the user observations were pre-analysed to understand to what extent the post-use examples inspired the initial design ideas. The students might also be inspired subconsciously by the user observations, and might not be aware of it and not reveal this during the interviews. This might have implications for limiting the number of the design concepts to be analysed and presented in this study. All of the sixteen design concepts in total were analysed and categorized below that either the students or the researcher considered as being inspired by the user observations. Only exemplary cases for each category were presented in Table 4.2 based on the analysis of the initial design concepts and the findings from the in-depth interviews.

Table 4.1 *Categorization of design concepts according to responses*

Categories		*Pre-analysis: matching the concept with the visual recordings	Number of concepts
A	The student stated that the concept was inspired by the user observations, and the student matched it with users' post-use examples/solutions (i.e. visual recordings).	Matched	2
B	The student stated that the concept was inspired by the user observations, and the student did not match it with users' post-use examples/solutions.	Matched	3
C	The student stated that the concept was inspired by the user observations and the student did not match it with users' post-use examples/solutions.	Not matched	2
D	The student did not confirm that the concept was inspired by the user observations and visual recordings.	Matched	9

*Initial analysis supported the fact that the design concept was matched or not matched with the visual recordings from the user observations.

Post-use dimensions for sustainability. Various post-use dimensions emerged through the user observations were retrieved from the students' responses. Those were *personalization*, *affordability*, *engaging* and *locally inspired*.

Personalization (8) was the most frequently mentioned dimension for the post-use design solutions. Each student assessed and incorporated this dimension differently with respect to the results from the user observations. For instance, *Student 2* defined personalization as "allowing user to apply unlimited variations on glass packaging", while *Student 4* defined it as "adding a personal value to product to make it more diverse and attractive" (Table 4.2). Engaging solutions (3) and affordability (3) were equally mentioned considering the students' responses. The notion of locally inspired was only mentioned by one student as an inspirational dimension for the post-use design concept. To enrich the students' understandings of the context and the use of post-use dimensions, it would be useful to gather, analyse and include more post-use examples from the user observations which would eventually lead to more inspiring and diverse design solutions.

Table 4.2 illustrates some of the post-use design concepts, and how the user observations (e.g. users' post use examples) inspired and informed them. First column shows the category (Table 4.1) in which the student belongs to. The second and third columns present the design concepts including their descriptions. The fourth column presents the visual recordings from the user observations informing the design solutions. Finally, the last column includes post-use dimensions emerged from the user observations. For instance, *Student 1* develops a pomegranate sauce bottle concept that turns into a candle stick during post-use phase. The design concept is based on a conclusion drawn from the user observations considering people's intention to put something inside a product for decorative purposes during post-use phase. Thus, the student defines personalization particularly in this design solution as “allowing users to put various materials in glass packaging”.

Table 4.2 *Selected post-use design concepts in terms of their relationship with user observations and post-use dimensions*

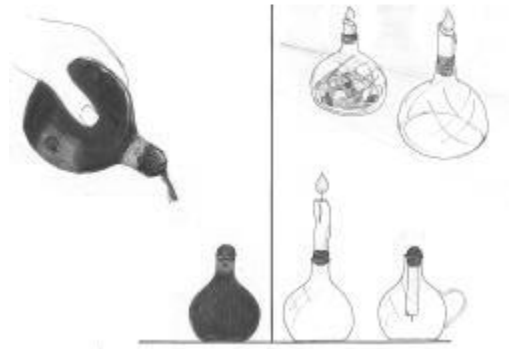
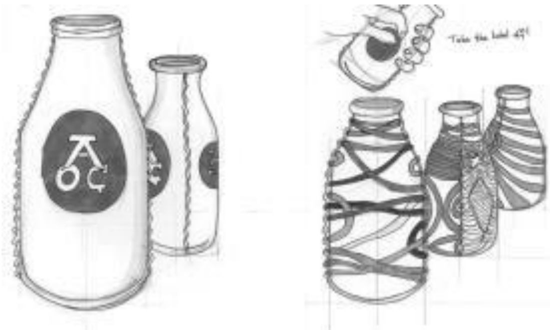
	Design concept	Post-use examples from user observations	Post-use dimensions
Student 1 (Category A)	 Design concept by Sıla Karagoz Use: Pomegranate sauce bottle; Post-use: Candle stick Ornamental materials (e.g. dried flowers, beads, etc.) can be put in the bottle for the post-use phase. Through a specialized feature, the lid of the bottle is replaced upside down and the candle stick is inserted into the lid. The form of the body of the glass packaging is inspired by pomegranate.	 The user puts ornamental materials in the glass packaging for decorative purposes.	**Personalization:** Allowing users to put various materials in glass packaging (e.g. jars and bottles)
Student 2 (Category A)	 Design concept by Yasemin Donmez Use: Milk bottle; Post-use: Water bottle During the post-use phase, strings with various colours are wrapped around gravures on the bottle as a water bottle sleeve for aesthetic value, and protection and non-slip grip features.	 The user personalizes the jar through covering it with knitting to make it a decorative object.	**Personalization:** Allowing users to make unlimited variations or changes on glass packaging by applying hand-made pouches

Table 4.2 *Selected post-use design concepts in terms of their relationship with user observations and post-use dimensions (Continued)*

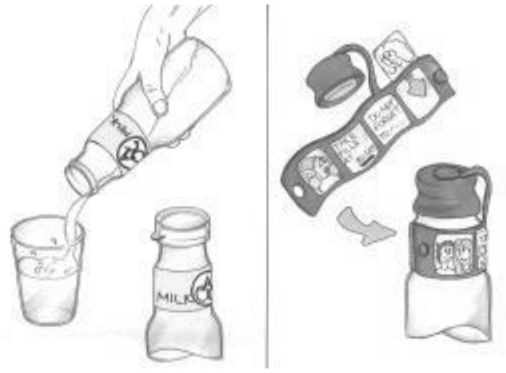
	Design concept	Post-use examples from user observations	Post-use dimensions
Student 3 (Category B)	 Design concept by Koray Benli Use: Honey jar; Post-use: Candle jar Robes and strings go through the holes on the lid of the jar, which allows potential users to demonstrate their skills and creativity, and provides different patterns for light and shadow effects and different usage scenarios.	 Robes or strings with various colours, thicknesses and materials are available at users' homes.	**Engaging:** Incorporating users into post use phase by allowing them to use various robes or strings through wrapping them around jar in order to create diverse light and shadow effects
Student 4 (Category C)	 Design concept by Buse Üstün Use: Milk bottle; Post-use: Water bottle Pictures and/or notes can be inserted into an accessory placed on the neck of the bottle and connected to the lid, which adds a personal value to the water bottle and makes it more attractive for potentials users.	Based on the findings from the observations, users would add something to glass packaging to reuse it after its initial use for personalization.	**Personalization:** Adding a personal value (e.g. photographs, memory, notes) to glass packaging to make it more attractive for post-use

Table 4.2 *Selected post-use design concepts in terms of their relationship with user observations and post-use dimensions (Continued)*

	Design concept	**Post-use examples from user observations**	**Post-use dimensions**
Student 5 (Category D)	 Design concept by Sirin Cincioglu Use: Wine bottle; Post-use: Water bottle The design concept is inspired by water vessel shape and covered with straw based strings and/or robes for a water bottle sleeve holding both aesthetic and functional value.	 The user incorporates locally available materials for decorative purposes for the post-use phase.	**Locally inspired:** Usage of locally available materials (e.g. straw) and resemblance of the form to the ancient water vessel shape

Based on the post-use examples from the user observations, it was concluded that these examples have a main emphasis on decorating glass packaging products. However, the students re-contextualised these inspirational examples in terms of both aesthetic and functional values. For instance, a personalized decorative object was reconceptualised in a water bottle sleeve as the post-use design concept embodying both aesthetic and functional (i.e. non-slip grip and protection of the glass packaging) features developed by *Student 2*. Similarly, decorative strings covering a water bottle inspired a post-use design accessory for a candle jar, which allow potential users demonstrate their skills and creativity, and provide different patterns for light and shadow effects presented by *Student 3*. Although the post-use examples from the user observations were mainly based on aesthetic values, some students were able to reinterpret these to bring together both aesthetics and function (e.g. candle jar shade, water bottle sleeve, etc.).

4.1.2 Online Survey

After the completion of the in-depth interviews, an online survey was sent to the whole third year industrial design students to better understand the contributions of the user observations to the idea generation phase of the project. The survey included two questions. The first question was about to what extent they benefitted from the user observations for the idea generation phase, and the second one was about the implications of the user observations for the design concepts.

Number of the students that replied the survey was 23 out of 37. The students mainly stated that the user observations helped them better understand the concept of *post-use* and *re-contextualization*. This included diverse post-use scenarios for glass packaging, problems and challenges encountered while transforming a glass packaging into another product, and people's needs, behaviours, expectations and intentions regarding post-use. Main findings are as below:

- People tend to collect same glass packaging for post-use to make or complete a set (i.e. family of products).
- Aesthetic features of glass packaging are important for people to keep it for a long time. For instance, people might purchase a product considering the post-use of glass packaging, if they find it aesthetically appealing.
- People prefer to transform glass packaging for post-use purposes through simple processes. Removing the label is a difficult phase while transforming a product for post-use.
- Post-use processes would be diversified based on user's gender, age and lifestyle. For instance, at student homes or in dormitories, bottles or jars are reused through making simple changes on glass packaging such as removing the label to basically store food. However, at domestic households, people tend to apply ornaments to personalize the glass packaging in a more complicated way through using their craft skills.
- People commonly prefer to add personal value to products for post-use purposes.

The findings and insights from the user observations expanded the students' vision on generating new ideas, and identified their constraints and limitations for the project. They also gathered a great amount of information related to post-use in a very limited time as they shared the findings of their research with the whole class.

The main limitation as stated by the student was that most of the examples from the user observations were on reusing glass packaging for storing food and beverages. During the observations, the students found out fewer examples for the project post-use categories such as candle jar, water bottle, bathroom accessories. Thus, the students analysed the current examples more thoroughly in order to transfer that knowledge into the proposed post-use categories considering the user observations. They were limited with the existing examples and the information that the users explicitly express during the observations.

4.2 Conclusion

The main emphasis of the user observations was on the post-use phase in this project. For developing further projects in design education, it might also be useful to include and emphasize both use and post-use phases in user observations in order to encourage diverse design solutions and to better link use and post-use design solutions.

Post-use design thinking is an evolving research area in design for sustainability which prolongs lifespans of products by allowing enduring relationships between products and users. To this end, post-use considerations should be incorporated into early stages of design process, and those considerations should be informed by user knowledge to propose more locally relevant solutions for people.

People's involvement in idea generation phase is critical in terms of product design especially for sustainability, since it is essential for designers to understand people's needs, preferences and expectations at local level in order to bridge the gap between users and sustainable design solutions. In this study, the user observation method was presented to illustrate the findings on how design research informed the post-use dimensions (e.g. personalization, locally inspired, engaging, affordability) and the design concepts, and how that information from this exploratory research on post-use was integrated into the idea generation phase of the design process. In line with user observations, generative and innovative design research methods and techniques involving people in product design and development process would have the potentials for inspiring and informing alternative design solutions, since generative research methods would provide designers more in-depth understanding of user needs and experiences. Thus, to explore the potentials of generative research in product design process, the ERM as a generative research method was developed and implemented in diverse educational design projects and three field studies were conducted. In the following chapters, these field studies will be presented.

CHAPTER 5

PRIMARY CASE I: MY SUSTAINABLE MINI OVEN

The Experience Reflection Modelling (ERM) was developed, and firstly implemented into a third year undergraduate design project as a generative research method. The project namely “My Sustainable Mini Oven” was developed and undertaken in collaboration with Profilo in the Department of Industrial Design at METU from April 6th to June 10th, 2011 (Appendix D).

This project aimed to develop design solutions for mini oven and further emphasized its economic and practical aspects by incorporating sustainable design considerations. The main objective of the project was to rethink and re-contextualize mini oven considering its whole product lifespan.

Main target group of this project was local users and households with low-middle income level. In addition to typical mini oven users, other potential mini oven users will also be taken into consideration such as households with small children, student and bachelor households, working single parents, elderly people living alone, et cetera.

Developing design solutions which considers whole lifespan of a product including both use and post-use phases (i.e. repair, reuse and recovery) is a critical sustainable design consideration, specifically for household goods and appliances with innovative product-service systems solutions.

Product maintenance and repair, engaging design solutions for serving, hosting, cooking, and energy efficiency and consumption focusing on user behaviours are the significant sustainable design considerations within the context of this project. These considerations emphasized both technical and socio-cultural aspects of product lifespan of a mini oven.

5.1 Project Phases

The project lasted nine weeks with the participation of 26 students. The design research phase of the project was conducted by teams with five or six members whereas the idea generation phase was conducted individually (Figure 5.1).

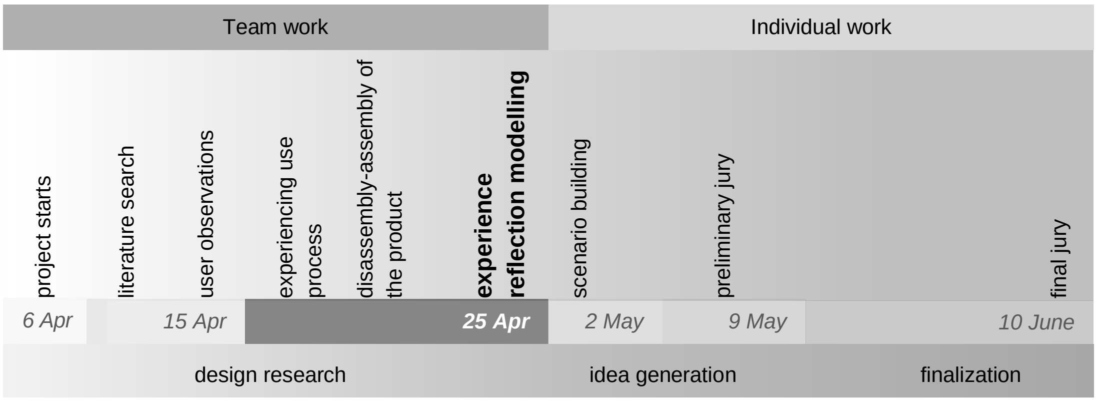


Figure 5.1 Phases of My Sustainable Mini Oven project

Literature search and user observations. During the literature search, each team focused on a given topic such as oven types and working principles of ovens, safety issues in ovens, current mini ovens in local and global market, sustainability and design, new approaches in kitchen white goods. At the same time with the literature searches, each team carried out field observations and interviews on mini ovens used in private homes and offices. During user visits, the students observed the activities carried out (preferably while users are preparing, cooking/baking and serving) and the space in which the activity took place. They documented the process with still images, video and voice recordings, notes and sketches, and presented the outcomes. The user observation phase was probing for the Experience Reflection Modelling, since the users participating this phase were recruited for the ERM sessions.

Experiencing use process. This phase enabled the students to have a use experience (e.g. preparation, baking, serving) with two different brands of mini oven in the design studio. It was a first-hand baking experience for some students; they had the chance to bake together with the experienced students.

Disassembly-assembly of the product. The session was carried out with Profilo service personnel. The aim of this session was to better understand working principles, technical details and basic parts of a mini oven, and to gain an understanding about the appliances in terms of maintenance.

Phases up to the Experience Reflection Modelling aimed to enrich the students' knowledge about the issue and to increase their control on following phases. After the ERM, the students carried out following phases individually in the design and development process. Sustainable design considerations in the project brief were taken into consideration throughout the design research, idea generation, finalizing the design solution and assessment of the solution phases.

5.2 Experience Reflection Modelling (ERM)

To understand local knowledge and relationships between users and sustainable design considerations in the project brief, the Experience Reflection Modelling was developed and implemented in the *My Sustainable Mini Oven* project. The aim of this phase was to conduct exploratory and generative ERM sessions with the participants that the student teams met during the user observation phase. The ERM as a generative research method helped the participants reflect and express their experiences and preferences thoroughly related to the whole lifespan of a mini oven (i.e. defrosting, baking, roasting, grilling, serving, care and cleaning, storing, repairing, upgrading, etc.) (Appendix E).

During the session, the students asked questions to the participant about her/his mini oven experiences and preferences by using the ERM interview schedule provided. In response to that the participant expressed her/his thoughts (i.e. she/he "thinks aloud") as she/he brought together the components of a mini oven by using the toolkit provided (Figure 5.2). The session proceeded step by step with the responses of the participant and the development of the 3D model. This process helped the participant recall his/her experiences about the product and reflect his/her preferences and needs related to the product. Thus, active participation of the participant into the process was essential.

Figure 5.2 An example of an ERM session

The ERM method emphasizes to generate information with participants rather than to design with them. Unlike final 3D model itself, the focus of the ERM is to understand participants' priorities and preferences with their reasons while they bring together components of the 3D model. Interaction taking place with the use of a 3D modelling toolkit accompanying interview and video recording aims to retrieve tacit and latent knowledge by enabling the participant to realize and recall the use context. Thus, the ERM is appropriate for early stages of product design process to generate input for idea generation phase.

The phases of the ERM implemented in the mini oven project were:

- Preparation of a 3D modelling toolkit and an interview schedule

- Conducting a pilot ERM session
- Reviewing the 3D modelling toolkit and the interview schedule
- Recruiting the participants and arranging the appointments
- Setting-up the research environment
- Conducting the ERM session by using the ERM interview schedule and the toolkit provided
- Analysing the ERM session
- Creating the themes that define the potential solution areas

The 3D modelling toolkit and the interview schedule that were used in the mini oven project were developed with the contributions of the tutors of the course ID 301 through a pilot ERM session. Before starting the ERM sessions, information about the ERM method and the pilot session was given to the students through a lecture by the researcher. After this lecture, the students prepared their toolkits, conducted and analysed the sessions as a team.

5.2.1 The ERM Toolkit

The ERM toolkit included simple 2D and 3D forms representing various potential components of a mini oven such as main body, door, handle, trays, shelves, racks, controls and displays, hot plates, cable, feet, et cetera. It also included different materials such as coloured pens and pencils, paper tape, string, wire, play dough, various types of papers, fabrics, etc. to tailor the model to the specific requests or needs of the participants (Figure 5.3).

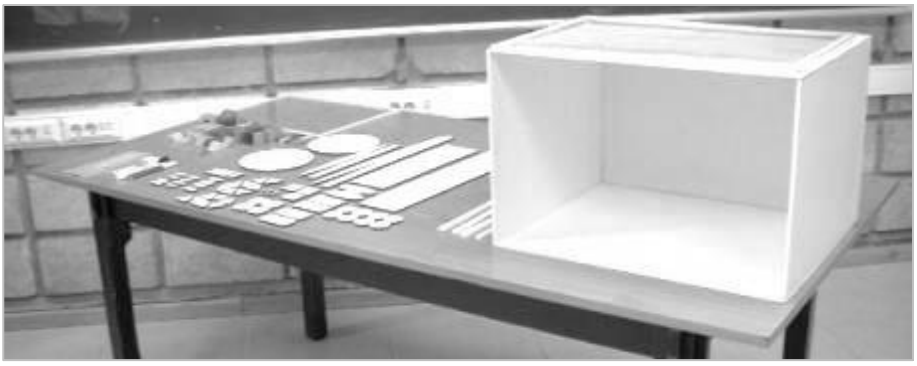


Figure 5.3 The ERM toolkit used in the mini oven project

For the pilot ERM session, the researcher developed the components of the ERM toolkit for the mini oven project that were drawn by a vector drawing program, and then produced from a paper based material by using laser cutter. Vector drawings related to the toolkit were distributed to the students before the ERM sessions started. The student teams were allowed to make small adjustments on the proposed components. The researcher experienced that removable and reusable putty-like adhesive such as Tack-it, Blu-Tack, etc. were more affordable and practical than Velcro. Thus, they were used to bring together the components of the toolkit.

5.2.2 The ERM Interview Schedule

The ERM interview schedule consists of brief information about the research that will be given to the participant and questions that will be asked to the participant (Appendix F). The questions are based on use process and lifespan of a product which the participant has experienced before. To this end, the ERM interview schedule that was used in the mini oven project covered the processes of preparation for baking, baking, serving, cleaning, maintenance and repair of a mini oven. The participants envisioned these processes through bringing together the components of a mini oven by using the ERM toolkit, and responded the questions related to these processes through thinking aloud. The ERM interview schedule for the mini oven project consisted of 54 questions and sub-questions in total. The questions were specially developed to understand the relationships between user experience and the sustainable design considerations in the project brief. For instance, opening the mini oven door during the baking process might not be perceived as increasing of energy consumption by the participant. This behaviour would be to check whether the food was ready. Instead of asking the participant his/her opinions about energy consumption, “how often do you check your food during baking?” was asked, and he/she was also asked to perform on the 3D model. If the participant checked the food by opening the mini oven door, questions like “would you prefer to check in a different way? Why?” were asked to gather more information for encouraging design solutions related to changing the behaviour for energy effectiveness.

5.2.3 The ERM Sessions

Each student teams visited homes and interviewed with at least two different participants at the early phases of the project. At the ERM phase, one of those participants was invited to METU for the ERM sessions. A room at the Faculty of Architecture building was reserved for the sessions and was equipped with video recording and the ERM toolkit. Five sessions, conducted by each team in two days, each lasted approximately 55 minutes.

There was only one participant in each session, since the ERM interview schedule accompanied squentially by the 3D modelling process was used in the ERM sessions. Information about the research was given to the participant, and a consent form was signed. The sessions were video and audio recorded. Active involvement of the participant was encouraged, however if the participant asked for help, the design students helped the participant in the 3D modelling process without directing him/her. The participant was allowed to make any changes on the 3D model of the mini oven during the sessions. At the end of the session, the participant completed the whole 3D model of the mini oven (Figure 5.4).

Figure 5.4 Examples of mini ovens that participants built up during the ERM sessions

5.2.4 The ERM Analysis

An ERM analysis sheet was developed for the analysis of the sessions. The analysis sheet included selected video frame(s) regarding the analysis, a quote from the transcription of the participant's expressions, insights for the analysed part, the title summarizing the quote, the theme representing the insight, time slot of the video frame, demographics of the participant (e.g. gender, age, occupation, etc.), and the names of the team members conducting the session (Figure 5.5).

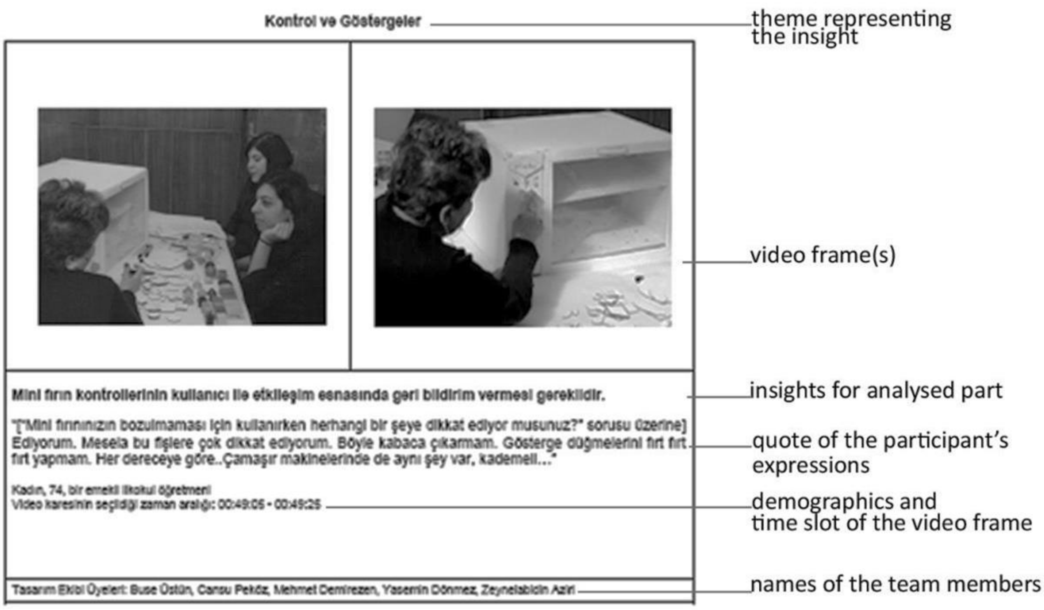


Figure 5.5 The ERM analysis sheet

The student teams chose at least ten frames from the video stream that they found inspiring and credible for the idea generation phase. Five teams analysed 56 video frames in total. Controls and displays, maintenance and repair, and energy efficiency and consumption were mostly mentioned topics in the analysis sheets. Serving, hosting and local values were following them. There were other topics mentioned in the ERM analysis sheets such as problems related with mobility of a mini oven, accidents, mini oven parts and visual features of a mini oven.

All analysis sheets were displayed on the boards in the third year studio so that all analyses were shared with all students. Each student reviewed all the ERM analysis sheets prepared by the student teams, and highlighted approximately ten findings with coloured stickers that she/he considered as significant within the project context. This technique made noteworthy findings and insights more visible. After this phase, to define design solution areas, each team prepared posters related to five different themes (i.e. serving, hosting and local culture; maintenance, cleaning and repair; energy efficiency and consumption in relation to usage patterns; controls and displays; and other) through discussions of the analysis sheets. The teams categorized the findings for and insights into relevant sub-topics, and prepared a poster bringing together the theme and sub-themes (Figure 5.6). Then, that categorization of the themes and sub-themes became the basis for the idea generation phase of the mini oven project.

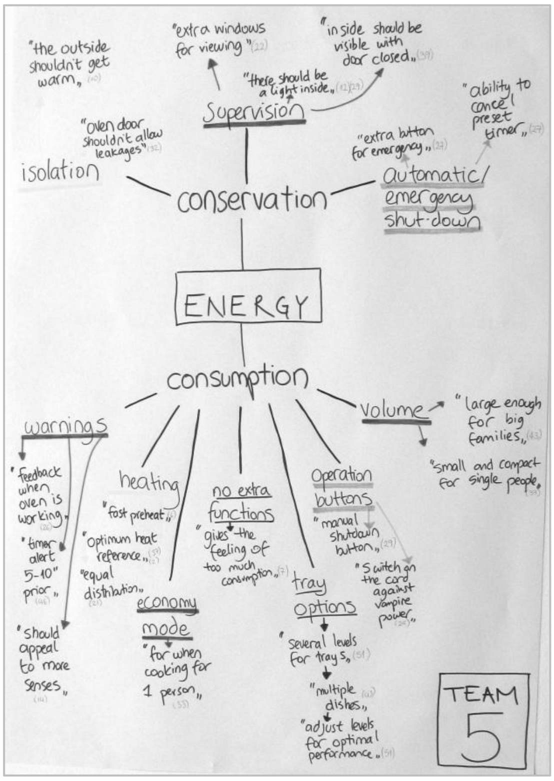


Figure 5.6 The emerging themes poster of Team E

5.3 Revisiting the ERM Framework

This field research case was the first implementation of the ERM in a design project. It aimed to explore how the ERM could be integrated into product design and development process, and which techniques and tools and how design considerations could be incorporated into the ERM.

At the very early phases of this research, the researcher was responsible for the development of the ERM. After the pilot ERM session, the interview schedule and the analysis sheet were finalized with the involvement of the studio tutors. Preparations for the ERM sessions and conducting the ERM were mainly the responsibility of the student teams. The background of the researcher and the composition of the people in the research would have a direct effect on the research. In this case, the background and the perspective of the researcher about the topic explored in this study affected the formulation of research questions, the development of the ERM method and the study plan. Similarly, the studio tutors and the students had an effect on the process and the results of the ERM sessions. On the other hand, for the relevance of the doctoral study, it was considered important to conduct sequential field studies by considering the limitations of and findings from this case. To determine further researches, the process of this case is revisited below according to the framework of the ERM.

5.3.1 In Terms of Product Design and Development Process

In this case, the ERM took place between the user observations and the idea generation phase, since the user observations enabled the design students to gain insights and helped the participants think thoroughly about the project topic (i.e. mini oven), and it provided user information as an input for the idea generation phase.

The ERM sessions involving 3D modelling and interview techniques enabled the students to relate the visual data generated by the participant’s modelling with the verbal data generated by the participant’s wording. This process was a preparation phase for the idea generation by focusing on user experience.

The students experienced a research process that enriched the novice designer-participant interaction. Thus, the students explored and understood real mini oven user, use context, user behaviours, and local values related to mini oven thoroughly that enabled them to generate ideas based on user experience.

Additionally, conducting a pilot ERM session beforehand, providing interview schedule, toolkit, and analysis sheet to students, and using the same research environment for the sessions allowed the students to just focus on the ERM sessions and the results of the sessions for the idea generation. On the other hand, the pilot ERM session was essential for the researcher to explore the constraints and limitations of the method for the following phases. After the pilot session, adjustments were made on the interview schedule and the toolkit. For the further researches, it would also be essential to conduct a pilot session.

5.3.2 In Terms of Generative Research and Participants

In this case, the participants of the ERM sessions were recruited from the user observations. Thus, the participants were familiar with the research topic when they were invited to the sessions. This enabled the researcher and the studio tutors to eliminate warm-up sessions before the generative design research. A warm-up session such as mind mapping, collage making can be added prior to the ERM sessions for the further studies. It is essential to conduct a warm-up session if user observations are not part of the design process.

The last two questions in the interview schedule encouraged participants to involve more actively in the making process, since they were related to the further expectations and suggestions of the participants for exploring improvements and other features of the mini oven (Appendix F).

5.3.3 In Terms of Product Lifespan and Development of Sustainability Considerations

The ERM interview schedule used in the mini oven project addressed the product lifespan of a mini oven, and it was prepared in relation to the sustainable design considerations included in the design brief. By this way, the students realized the potential design solution areas by exploring user behaviours that appeared to be important in terms of sustainability. The findings and insights from the ERM analysis related with the sustainable design considerations are presented below. The students considered all three sustainability considerations during the development of their ideas, however the examples below are categorized based on the prominent design solutions for the considerations.

Product maintenance and repair. One of the most mentioned topic about product maintenance was cleaning of a mini oven. Parts of a mini oven should be cleaned easily after baking phase, which also included ease of cleaning of trays, mini oven door, door handle, controls, heating parts and inside of a mini oven. Heating parts of a mini oven should be hidden, since they were found to be the most difficult parts to be maintained and cleaned. Additionally, the participants wanted to refurbish and replace easily worn-out parts such as trays, controls and handle for product maintenance and repair. Moreover, design solutions would also enable them to renew and personalize some parts of the mini oven to prolong the lifespan of the product.

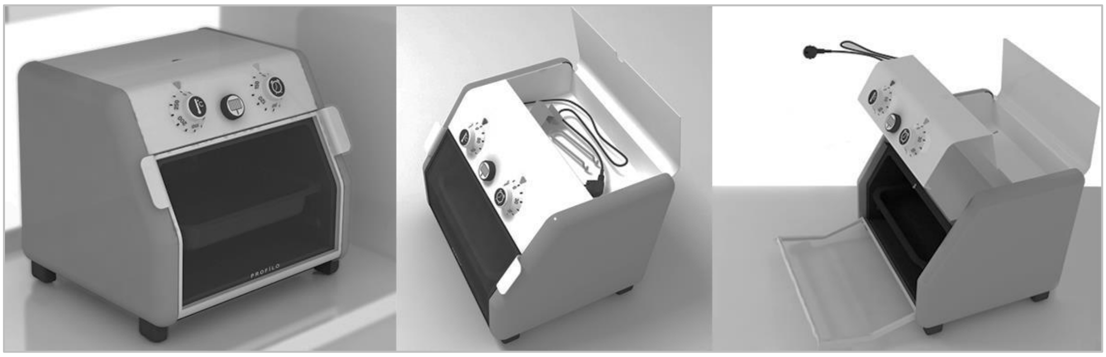


Figure 5.7 Tiny oven, by Koray Benli

In the example below, the student focuses on all three sustainability considerations (Figure 5.7). *Tiny oven* as a design concept is a compact unit for baking and grilling, occupies less space, thus consumes less energy than typical mini ovens. There are storage parts for electronic cords and oven accessories for better carrying and storing conditions. Thirty degree angled glass door enables users to check baking process. However, the main consideration in this design solution is product maintenance and repair to prolong the product lifespan. Controller part can be detached easily from the main body in order to simplify repair process. For the other parts of the mini oven, technician can easily access them without disassembling the whole mini oven.

Engaging design solutions. The participants did not prefer to use trays of a mini oven for serving, since they did not find them visually pleasing for hosting. Various accessories needed to be offered or rethought that facilitated service ritual. Body of a mini oven could enable people to personalize by adding decorative objects on it. Besides, the participants commonly expressed that they hid the mini oven under the counter or in closed environments, or placed it on the fridge unless they used it. As a result of this, they frequently changed the location of it in the kitchen. Thus, design solutions would support mobility or portability of the mini oven in the kitchen such as rethinking the body, handles and cable.

Figure 5.8 Take it Easy, by Güzin Şen

Take it easy oven above which is developed for single people eases serving phase of baking (Figure 5.8). After baking processes is over, user can take the tray out and easily place it on the special serving unit of the mini oven. With the help of the wooden serving unit, the user can serve the baked food with the tray. The bottom surface of the wooden unit does not directly contact with the surface of the kitchen counter or table.

Energy efficiency and consumption. Opening mini oven door to check food during baking was one of the most mentioned behaviour pattern in the sessions that resulted in energy consumption. Therefore, visibility of food in mini oven appeared to be critical to check the food without opening the door. Additionally, sealing of the mini oven door should be considered for increasing heat insulation. Furthermore, volume of the mini oven could be capable of baking more at once for energy effectiveness. Alternative design solutions should be offered for cooling off the mini oven, since the participants mentioned that they could not utilize the energy during cooling phase.

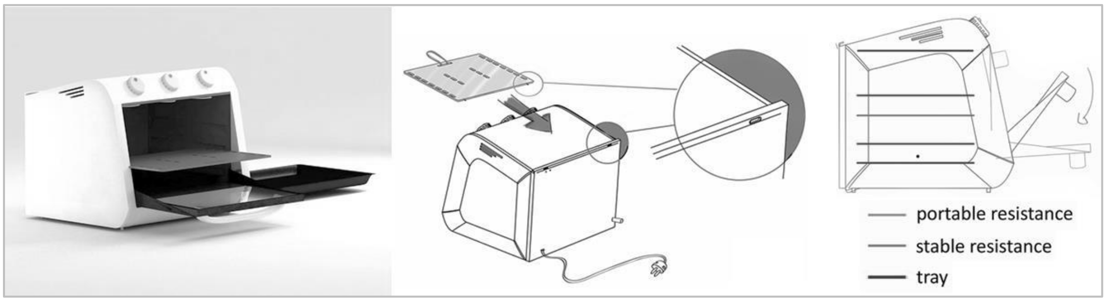


Figure 5.9 3sistance, by Hilal Coşkun

Current mini ovens are just developed for baking one tray, although users tend to use two trays to save time and energy. *3sistance* mini oven above allows users to bake two trays at the same time without changing positions of trays through providing a third resistance in the middle of the mini oven (Figure 5.9). Same voltage is divided into three resistances that reduce power of each resistance for equal distribution of heat. The portable resistances allow users to keep the food warm still after baking process is over. Moreover, angled door allows checking the food easily during baking.

5.4 Limitations and Projections for Further Researches

The ERM was implemented in a mini oven project in this research. Incorporating this method into a different eduacational project and developing toolkits, interview schedules for other product categories appear to be significant for developing the ERM method further. The analysis of further research case can offer some guidelines and tips for the designers and researchers who will use the ERM in their design research. This process would improve applicability and adaptability of the ERM.

An analysis sheet was used in the analysis phase of the ERM in the mini oven project. After this phase, an emerging theme exercise was conducted, and the students created sub-themes under the themes provided. In this phase, the students were asked to support emerging sub-themes with the instances of the analysis sheet. However, the findings were generalized or oversimplified, and detailed information retrieved from the ERM analysis sheets for the idea generation were not reflected on this emerging theme exercise. To this end, developing alternative analysis techniques to create inspiring emerging themes for idea generation phase and to relate the ERM with idea generation more effectively were considered as important considerations that were addressed in the further researches.

This research mainly focused on the implementation of the ERM in the design process. Opinions of participants and designers on the ERM process would be very valuable in terms of further development of the ERM method. To improve the ERM sessions and the 3D modelling experience, there needed complementary interviews and sessions with design students and participants to gain their insights while conducting the second and third primary cases.

CHAPTER 6

PRIMARY CASE II: ELECTRIC TEA MAKER AND ITS SERVING SET

The ERM was incorporated into a design education project (i.e. “My Sustainable Mini Oven”) in 2011, spring semester. Integration of the ERM into a different project appeared to be critical for the development of its phases.

The ERM was incorporated into a third year undergraduate design project as a generative research method. The project namely “Making Tea as an Engaging Practice: Electrical Tea Maker with its Serving Set” was developed and undertaken in collaboration with *Esse* in the Department of Industrial Design at METU at spring semester in 2012 (Appendix G). In addition to the implementation of the ERM in this project, observations, interviews and a questionnaire were conducted with the third year industrial design students and their participants in the ERM sessions to gain feedback regarding the phases of the ERM.

6.1 Making Tea as an Engaging Practice: Electrical Tea Maker with its Serving Set

The former case was oriented towards the development of the tools and techniques for the ERM on which the main focus was the integration of the ERM into a design education project. However, the main focus of this primary second case was to evaluate and enrich student engagement in the ERM process as well as the analysis phase of the ERM. This case particularly focuses on the implications of the ERM for another project through gaining insights of the students and the participants, and exploring and examining the analysis process and outcomes of the ERM.

In this field study, data triangulation was selected to comprehend the data retrieved from different research techniques and to enrich the rigour of the research (Robson, 2002). The field study composed of the implementation of ERM in a third year industrial design project; the observations during the ERM sessions, the interviews with both the student teams and the participants after the ERM sessions; the interviews with the students after the ERM analysis phase; and the questionnaire with the students on the findings from the former studies (Figure 6.1). At every stage of this research, the researcher wrote memos about her insights and observations, and audio recorded the discussions with her supervisor.

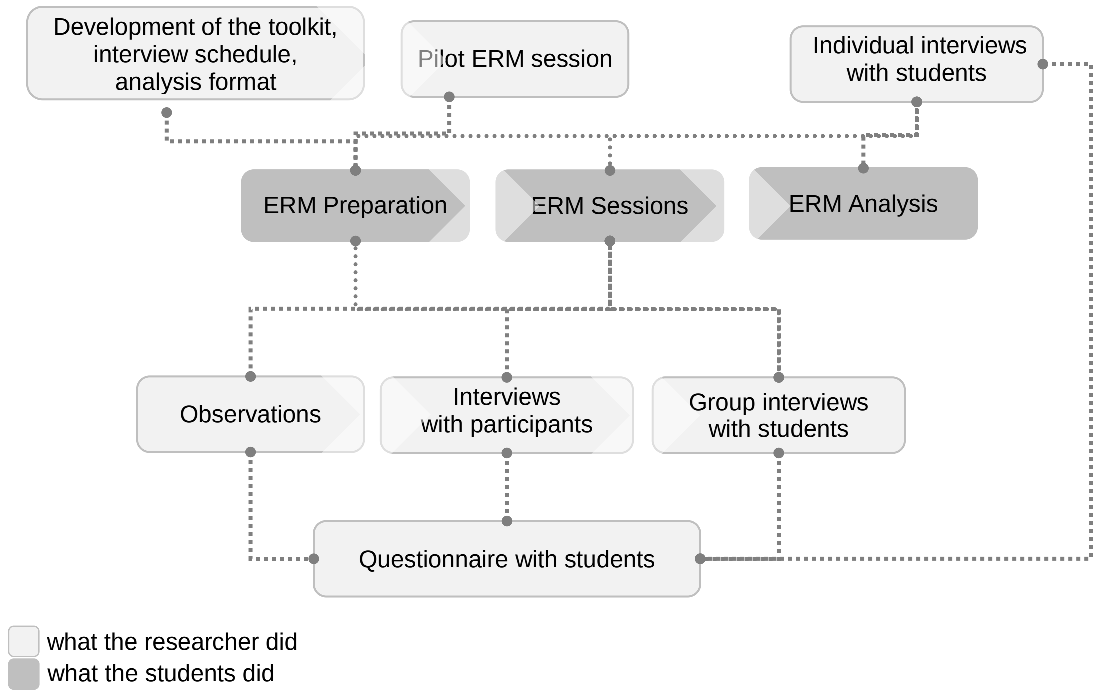


Figure 6.1 Structure of the current field study

The design project in this case aimed to reconsider making and serving tea, and to develop engaging design solutions which reinforced local values, encouraged maintenance and repair, and raised awareness about consumption of resources. The project was structured under three main sustainable design considerations which also specified the main considerations while developing the ERM interview schedule and ERM analysis format. Those considerations were:

- Incorporating local values, usage patterns and rituals
- Encouraging product maintenance and product part replacement
- Understanding resource consumption patterns and communicating the process of tea making

The main target user group and environment of this project was local users and households. In addition to typical users, other potential users and environments were also taken into consideration such as students in dormitories or workers in small workplaces.

The project phases were:

- Literature search and user observation (team, 2 weeks)
- Experience Reflection Modelling (ERM) sessions (team, 3 weeks)
- Disassembly and re-assembly session (one day)
- Initial design exploration (team and individual, 4 weeks)
- Preliminary evaluation (individual, 2 days)
- User testing and design detailing (individual, 3 weeks)
- 3D models and 2D presentation boards (individual, 2 weeks)
- Final evaluation (individual, 2 days)

6.2 Phases of the ERM Integrated Into Making Tea as an Engaging Practice Project

6.2.1. Preparation for the ERM

There were 33 industrial design students attending the third year industrial design studio and two of them were international students from The Royal Melbourne Institute of Technology (RMIT), Australia. At the beginning of the project, six teams were formed for the project. During the ERM phase, one team was divided into two because of the language barrier as requested by the student team involving international students. Throughout the ERM, there were seven teams that participated in this research. The student teams were responsible for all phases of the ERM.

The researcher conducted a pilot ERM session and revised the ERM interview schedule and the toolkit. Before starting the ERM phase, the pilot session and the ERM were presented to the students. Meanwhile, the ERM brief, the ERM interview schedule and the drawings of ERM toolkit were handed out (Appendix H, and I). The brief included descriptive summary of the ERM, the phases of the ERM along with the images and examples such as picture of the ERM toolkit and sample posters for the analysis.

After presenting the ERM, the students recruited their participants with whom they met during the user observations and prepared their toolkits. The ERM toolkit included simple and abstract 2D and 3D forms representing various potential components of an electrical tea maker and its serving set such as tea pot, handle, filter, base, spout, tea glass and saucer, et cetera. It also included different materials such as coloured pens and pencils, paper tape, wire, play-dough, coloured papers, fabrics, etc. to tailor the model to the specific requests or needs of the participants (Figure 6.2).

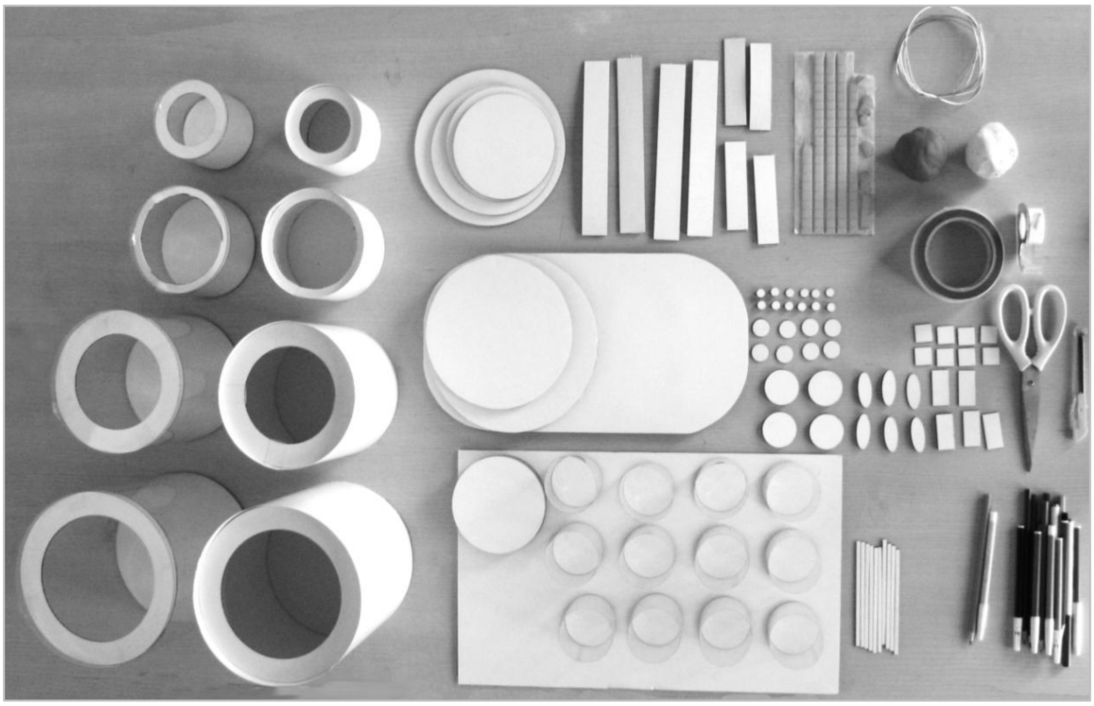


Figure 6.2 Sample toolkit for Making Tea as an Engaging Practice Project

The interview schedule was prepared both in English and in Turkish, since one team conducted the ERM session in English. The ERM interview schedule for this project consisted of brief information about the research and the questions that were asked to the participant. The questions were based on use process and lifespan of an electric tea maker and serving accessories which the participant had experienced before such as preparation for tea brewing, energy consumption, tea serving, cleaning, and maintenance. It also included questions about additional features and improvements of a tea maker and serving set. To get familiar with the toolkit, the interview schedule and the environment, the teams rehearsed the ERM session at will. Before the ERM sessions started, each team set up the ERM environment at UTEST (METU/BILTIR Product Usability Unit) by arranging the toolkit on a table and locating the video and audio recorder.

6.2.2 ERM Sessions

All ERM sessions were held at UTEST at the Faculty of Architecture; between March 15th and March 16th, 2012. Thank you letters prepared by the researcher were given to each participant after the sessions (Appendix AA).

During the ERM session, each student in a team were responsible for a particular task such as asking questions, helping participant for the 3D modelling and documentation. One student asked questions to the participant about her/his tea making experiences and preferences by using the ERM interview schedule provided. In response to that, the participant expressed her/his thoughts as she/he brought together the components of a tea maker and its serving set by using the toolkit provided (Figure 6.3). Active involvement of the participant was encouraged, however if the participant asked for help, one student helped the participant in 3D modelling process without directing him/her. The participant was allowed to make any changes on the 3D model during the session. At the end of the session, the participant completed the whole 3D model of a tea maker and its serving set.

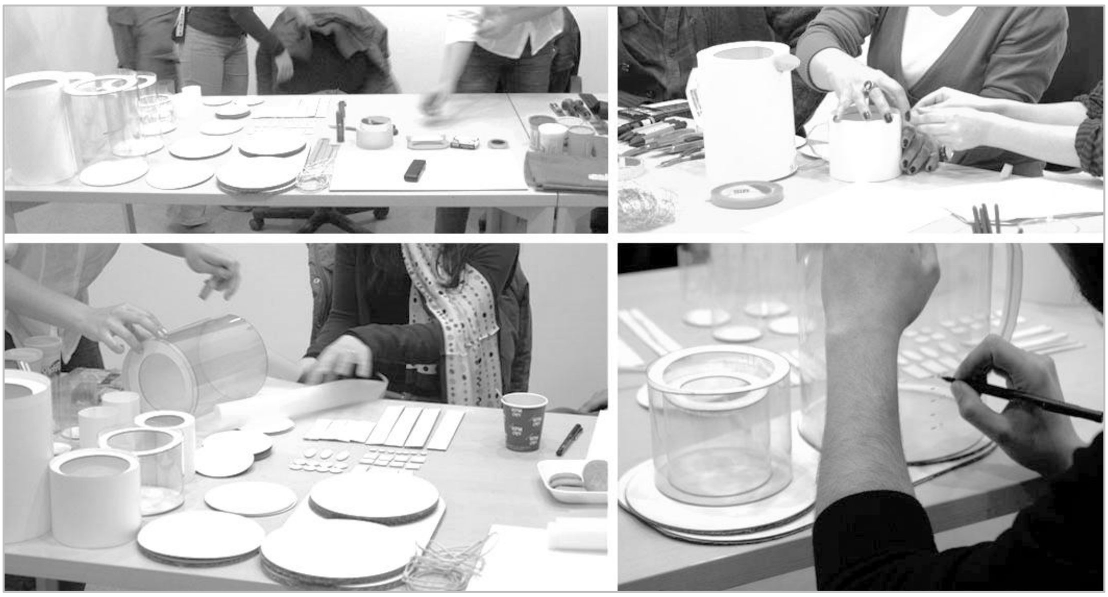


Figure 6.3 Snapshots from the ERM sessions

At least one student took pictures of the 3D modelling process and one student was responsible for video recording of the session. The relation between the 3D modelling and interview processes aimed to retrieve different levels of knowledge by enabling the participant to realize and recall the use context.

6.2.3 ERM Analysis

An analysis format was developed to help the students highlight significant and insightful statements made by the participants, and identify potential solution areas or emerging themes regarding the design project. To this end, the analysis format covered different abstraction levels (i.e. quotes/pictures, insights/conclusions from the raw data, emerging themes/potential design solution areas, clusters of themes, product directions/ideas) (Sleeswijk Visser, 2009) to help student make their own interpretations and conclusions. The students prepared and presented two presentation boards for the analysis phase (Figure 6.4). They were provided by sample analysis posters in the ERM brief.

Figure 6.4 Students in action for the ERM analysis

6.2.3.1 Analysis Part I

In this part, the student teams analysed their video recordings and selected at least 15 video sections that they found important from the ERM session. This selection was flexible rather than based on predetermined criteria. They presented these sections with verbatim transcriptions of the participant's statements with corresponding images selected from the video and/or camera recordings of the ERM session (Figure 6.5). Through transcriptions with images, it was aimed to keep the link between the interpretations of the students and the real users. After presenting those, the student teams developed their insights that were the interpretations of the participants' statements presented with the first poster. The student teams were supposed to identify the essence in the participant's statements, and then draw new ideas based on those statements. Interpretation should be inclusive and have the potential to enable the students to develop new design solution areas. They should not direct the students to a particular design solution. During the insight gaining phase, the student teams were supposed to make group discussions and drew a shared conclusion. Interpretations might be influenced by the personality and the background of the student. In order to have a shared insight related to the aims of the project, each student should have a voice and each insight should be discussed in the team. Shared insights had the potential to help the team uncover new ideas and find novel opportunities for potential design solution areas (Ylirisku & Buur, 2007).

After the insight gaining phase, the students developed several potential design solution areas based on their insights. Design solution areas are composed of phrases representing a theme which triggers discussion and inspires new idea opportunities for design. Ylirisku and Buur (2007) states that a theme meets some of the criteria listed below. A good theme title from video recording of sessions:

- "describes the action on video;
- exposes a relevant insight (such that once known, the design team may not proceed without it);
- bears new knowledge for the design team;
- inspires the designers;
- sets a new perspective on looking at matters;
- arouses new associations;
- manifests a clear rule for choosing content from the footage. "

Ylirisku & Buur (2007, p.116)

In the ERM analysis, the students were expected to develop inspirational design solution areas for new knowledge, and perspectives and associations that might uncover new opportunities for the project.

In sum, during the first phase of the ERM analysis, the students focused on what the participant said, and then reflected on the essence of the participant's statements with their own statements. Finally they reframed their interpretations by developing potential design solution areas (Figure 6.5).

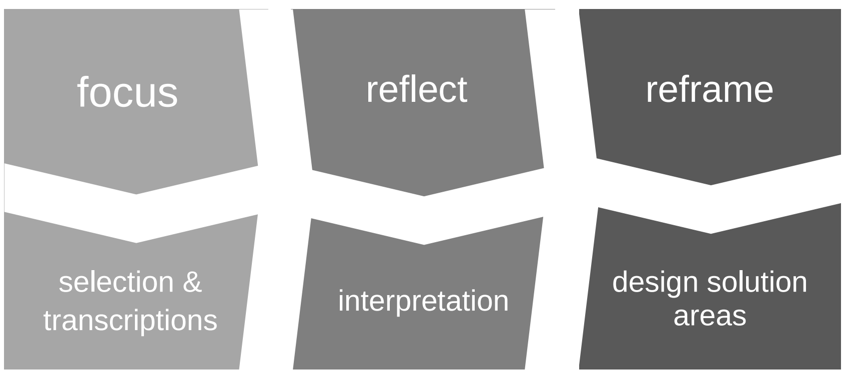


Figure 6.5 What happens when designers make sense of video (Adapted from Ylirisku & Buur, 2007)

The student teams presented their analysis by a presentation board both in English and in Turkish. Each presentation board included information about the participant, image of the electrical tea maker and the serving set that the participant actually used, image of the electrical tea maker and the serving set that the participant modelled during the ERM session, selected statements of the participant and corresponding images from the ERM session, students' insights from these statements, and their suggestions concerning the potential solution areas (Figure 6.6).

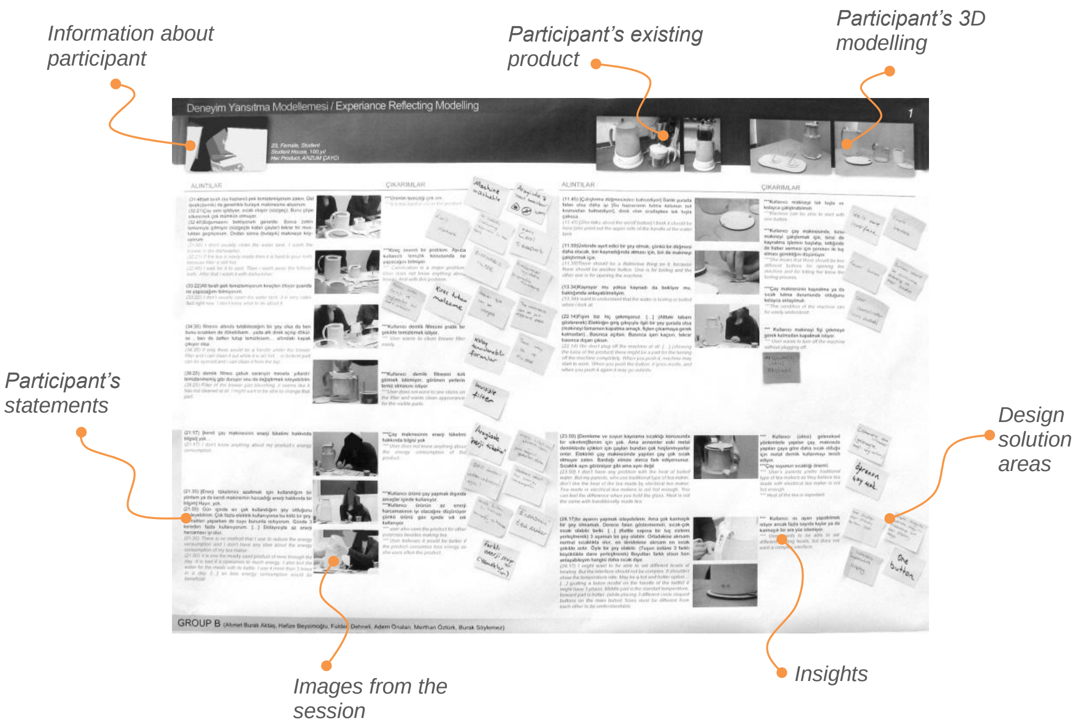


Figure 6.6 First poster of Team B

6.2.3.2 Analysis Part II

In this part, the student teams developed design solutions under the sustainable design considerations provided in the project brief (i.e. incorporating local values, usage patterns and rituals; encouraging product maintenance and product part replacement; understanding resource consumption patterns and communicating the process of tea brewing). Firstly, they categorized their potential solution areas under three main sustainable design considerations, and then they presented their initial ideas through quick sketching in relation to those design considerations. Hence, they transformed their verbal conclusions from the ERM into the visual representations which enabled them to integrate design research findings and insights into the idea generation phase. Quick sketches in this analysis part initiated divergence of ideas for the idea generation phase.

Different from the first one, the second poster of the teams included categorization of the potential design solution areas under three main project considerations, and initial sketches based on these solution areas (Figure 6.7). This poster was also prepared both in English and in Turkish.

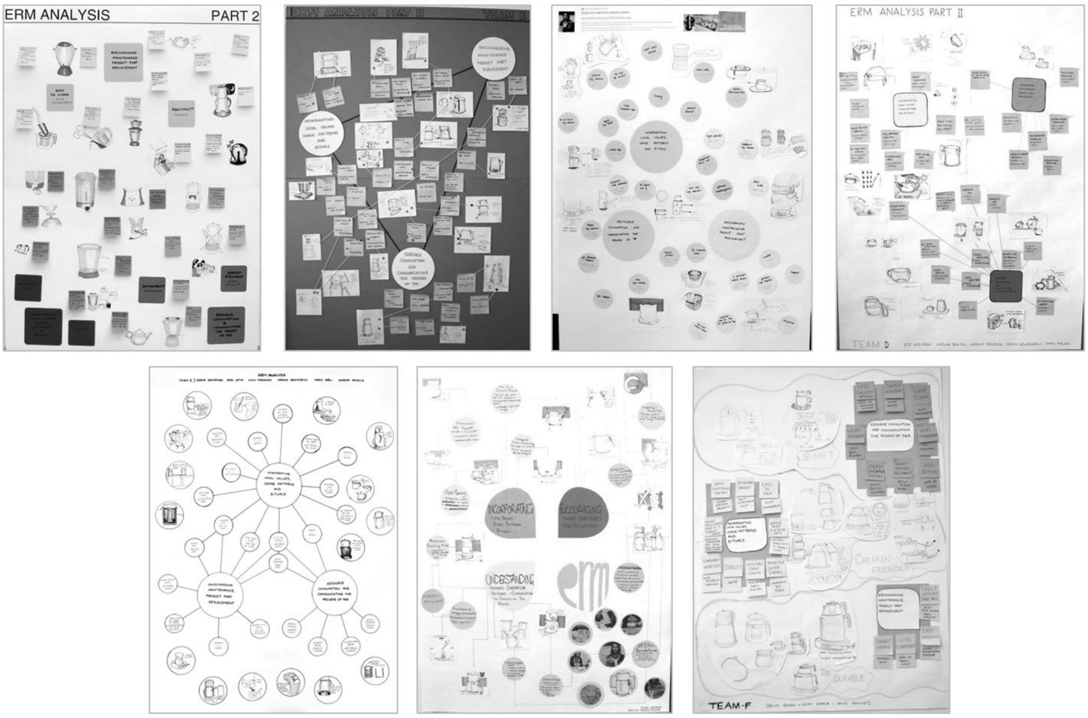


Figure 6.7 Second posters of all teams

After the analysis, the students pinned up their presentation boards on the third year studio boards to share the findings and outcomes of the ERM. Each student reviewed all the ERM analysis boards, selected their favourite design solution areas and put them under three main design consideration of the project. This technique made noteworthy patterns more visible. The outcomes of this exercise were used to develop themes for the further idea generation exercise (Figure 6.8).

Figure 6.8 Sharing phase

6.3 Field Study

Conclusions of the former field study were descriptive in terms of the development and implementation of the ERM, and mainly based on the insights of the researcher into the

ERM process. This field research aimed to gain insights into and reflections on the ERM from the students' point of view, since one of the main concerns of this doctoral study was to enrich engagement between students and tasks such as preparations for the session, conducting the session and analysis in the ERM. To this end, it is aimed to explore

- motives and barriers in the ERM process;
- factors that affected student engagement during the process;
- implications of the ERM method for idea generation phase;
- motives and barriers to use the ERM in students' design practice in the future (Figure 6.9).

Phase I - During and After the Sessions. This field study was developed under three main phases of the ERM such as preparation, session and analysis, and general assessment of the ERM. Due to the time limitation, the ERM preparation and session were considered together and questions related with these phases were asked at the same time after the ERM session of each team (Appendix J). During the ERM sessions, the researcher observed each session. For data triangulation, the checklist used during the observations showed similarities with the question items in the interview schedule for the group interviews (Appendix K). Group interviews were held with seven teams separately. Each lasted approximately half an hour. Before the interviews, a short interview was conducted with seven participants to understand their insights into the sessions. Each lasted approximately five minutes (Appendix L). This part was conducted at the same day with the ERM sessions.

Phase II - After the ERM Ends. Individual interviews related with the analysis phase of the ERM and general overview of the ERM were conducted after the analysis phase ended. The individual interviews were preferred since some students did not respond in depth during team interviews. For that reason, the interview schedule of this phase covered questions related to overall overview of the ERM as well as the ERM analysis (Appendix M). The semi-structured in-depth interviews were conducted with 33 students. Each interview lasted between 20 and 60 minutes. It started on 5th of April, 2012 and ended 25th of April, 2012. During the interviews, some pictures about the ERM sessions, ERM brief, pictures of the teamwork and submissions were shown to remind the students the process and to help the students exemplify their responses.

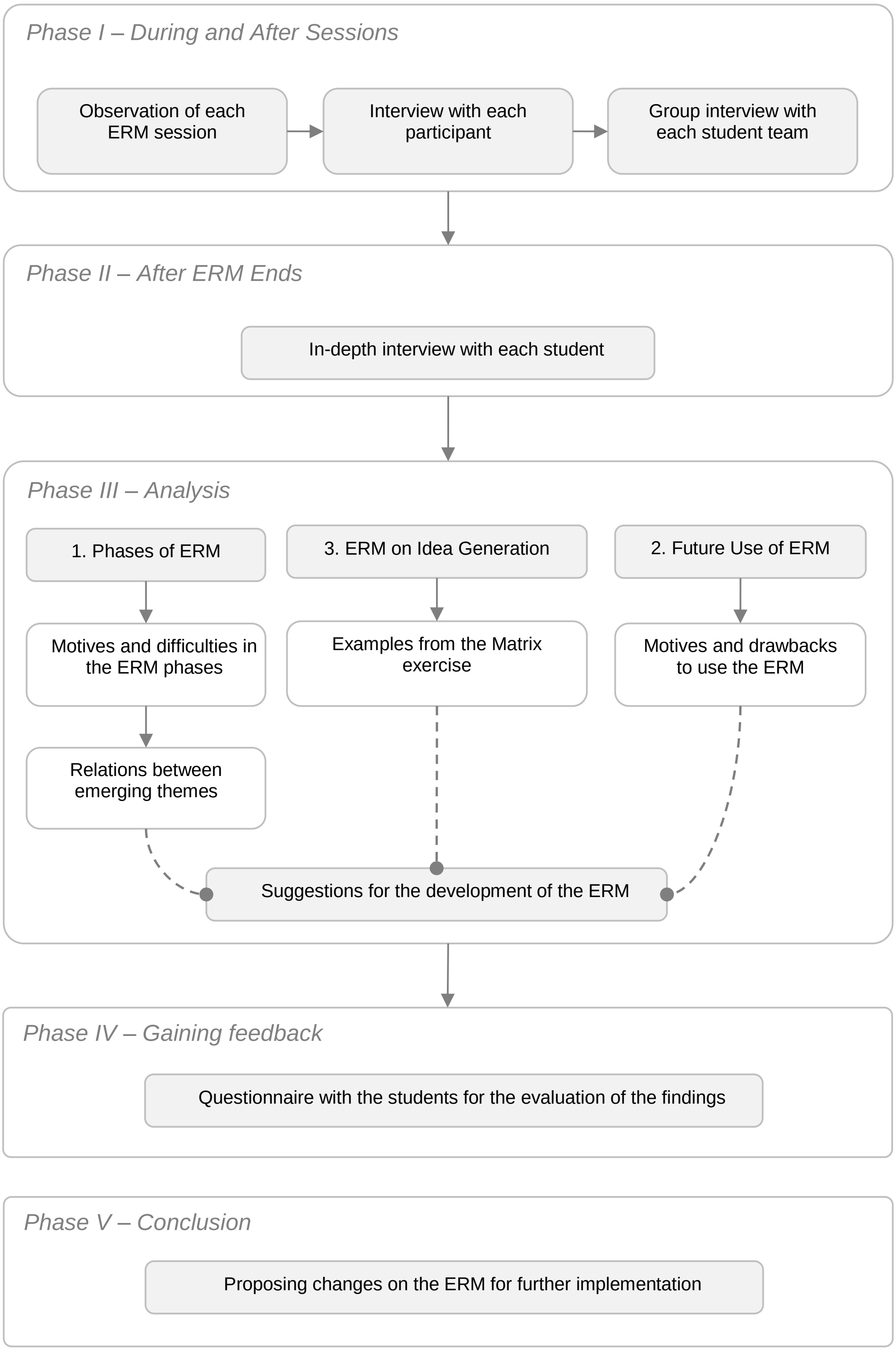


Figure 6.9 Field study plan for the second primary case

Phase III - Analysis. The analysis phase was developed through a holistic approach without separating the layers of data. In other words, observations, memos, and interviews were analysed together without losing the connection with the source of data. Each student team was considered as a case; consequently the analysis was done team by team.

For the analysis, a software program named as *NVivo* was used to organize the data according to the motivations and difficulties that the students experienced during the ERM phases, projections of the ERM on the idea generation phase, and factors affecting the use of the ERM in design practices of the students in the future.

Categorized data was transferred to *Office Excel* to gain insights into the data further. Occasionally, *Excel* sheets were printed out to organize the raw data tangibly (Figure 6.10). After gaining insights, some themes related with engagement such as clarity, teamwork, diversity in ideas, tangibility, modification, etc. were retrieved and developed from the raw data. A plugin of Excel named as *NodeXL* was used to see the patterns and inter-relations among those themes.

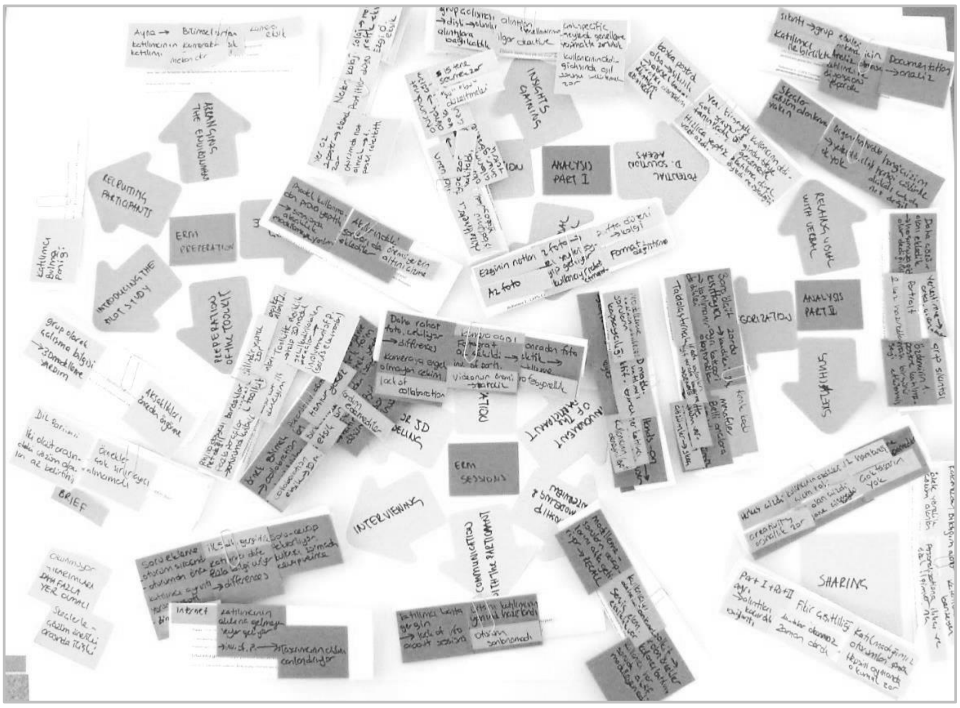


Figure 6.10 From raw data to insights for the Team A according to the phases of the ERM

Considering the research questions, the main core of the analysis was around the phases of the ERM such as preparation (introducing ERM, toolkit preparation, etc.), session (interviewing, documentation, etc.), and analysis (preparation of poster I and poster II). The findings from each team are brought together under the ERM phases in the following sections. Exclusive summary of the motivations and difficulties related with the ERM are stated.

Additionally, the data was analysed according to the students' implementation of the ERM in the idea generation phase and their intentions to use the ERM in future design projects. In the following sections, implications of the ERM for the idea generation phase are explained with examples. Moreover, understanding the intention to use the ERM in the future was critical, since the students responded the questions considering how they could develop and incorporate the ERM. Hence, they assessed the ERM from a wider perspective. They gave more information than they did during the questions related to the ERM phases. This will also be explained in the next sections.

For each phase of the analysis, the main objective was to understand the motivations and difficulties about the ERM that affected student engagement. This would be valuable to develop the ERM further. At the same time with the analysis of the teams, the researcher took notes on how a particular ERM phase could be improved further.

Phase IV - Gaining feedback. Based on the findings from the interviews and observations, a questionnaire was developed to evaluate the findings of the field study. The questionnaire included items that were the major interpretations that emerged from the data, and was handed out to the students who were the subject of the main field study. Since this stage was developed after the analysis ended, it was held in 15 February 2013 when the students enrolled in the fourth year.

Phase V - Conclusion. Based on the findings of the field study, solutions and suggestions that minimize the drawbacks and maximize the motivations are listed for the development and integration of the ERM as a research method enriching students' experience of engagement during generative research in product design and development process at undergraduate level. Some changes on the ERM method were proposed for the implementation in another educational case in spring semester of 2013 for gaining further feedback about the major conclusions from the study.

6.4 Findings Based on the ERM Phases

The ERM includes many phases from preparation to analysis as explained in the previous sections (Chapter 3).

- **Preparation** phase includes introducing the ERM, toolkit preparation, recruitment of participant, rehearsal, and setting up ERM environment.
- **Session** covers documentation, interviewing, helping 3D modelling, involvement of participant, and relationship between interviewing and 3D modelling.
- **Analysis** consists of two parts. First part includes transcription, gaining insights, development of design solution areas (DSAs) and relating those on poster I. Second part includes categorization of design solution areas under project considerations, sketching based on design solution areas and relating material on poster II.

Keeping students engaged and attentive at each phase of the ERM is critical for students' learning, performing tasks that they are supposed to do, and adapting their knowledge and perspectives into future situations (Wells-Papanek, 2009). In this study, engagement mainly means the interlock between students and task (i.e. ERM) (Reid & Solomonides, 2007), and students' intention to perform the ERM with pleasure, and to adapt the skills and knowledge gained from it in the future.

As one of the objectives was to understand the students' experience of engagement during the ERM, each phase of the ERM was presented according to the motivations and difficulties that the students encountered during the process. The raw data was analysed team by team, however the findings and insights were presented together in order to eliminate repetitions. The main and emerging themes are listed that have been retrieved from the data in the tables

(Tables 6.1, 6.2, 6.3, & 6.4). This theme list supports the relation diagrams presented in the following sections (Figures 6.31 & 6.32). It is aimed in Figures 6.31 and 6.32 to infer relations between themes in order to see the patterns in the motivations and difficulties in the ERM.

6.4.1 Preparation for the ERM

Preparation of the ERM included the presentation of the ERM to the students and the teams' preparation for the ERM sessions. It was the starting point and important to conduct the ERM phases effectively. In Table 6.1, the motivations and the difficulties faced by the students are given and each item are presented in the following sections in detail that are:

- Introducing the ERM
- Toolkit preparation
- Rehearsal
- Recruitment of the participant
- Setting up the ERM environment

Table 6.1 *Motivations and Difficulties during ERM preparation phase*

PREPARATION

	Introducing the ERM	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
motivations	The phases of the ERM were clear and well-defined in the brief that enabled most of the teams to work comfortably in an enjoyable and professional environment.		■	■	■	■		■	brief, clarity, professionalism
	Video samples of the pilot study in the introductory presentation helped the students understand the ERM session. Moreover, the sample posters representing the analysis poster I and II helped them during the ERM analysis.	■	■	■	■	■	■		video clips, session, sample poster, analysis
	The students explored and read what was written in the sample poster I in order to understand the ERM analysis part I.		■		■	■			sample poster I, part I
	The presentation clearly explained the ERM in detail. Thus, some student benefitted from the presentation rather than reading the brief.			■	■	■	■		presentation
difficulties	As the sample videos shared during the ERM presentation were from the pilot study that the researcher conducted individually, it didn't introduce how to work as a team during the ERM sessions.	■							video clips, introducing teamwork
	The duration of video clips shared during the presentation wasn't long enough to explain the interviewing process in detail in the ERM session.			■			■		video clips, duration of videos, interviewing
	Some teams thought that associating pictures with insights was difficult in the sample poster I.					■	■		sample poster I, associating pictures with insights
	There was no connection between DSAs and sketches in the sample poster II. Hence, the teams had difficulty in associating sketches with DSAs in the second analysis poster, especially sketches related to more than one design solution areas.	■	■		■	■	■		sample poster II, associating DSAs with sketches, intersecting DSAs
	Although the ERM brief included information about insights and design solution areas, it didn't explain the definition of them with examples.	■	■	■	■	■			brief, definition of insight and DSA
	The sample poster I didn't give the students an opportunity to make modifications on their first posters since it was so specific.		■		■				sample poster I, inflexibility, modification
	The sample poster I wasn't easy to read and follow since it had a text-based format with small size pictures.		■			■	■	■	sample poster I, text-based format, ease of reading

Table 6.1 *Motivations and Difficulties during ERM preparation phase (Continued)*

	Toolkit preparation	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
motivations	Some teams added new parts and materials such as black cardboard, aluminium foil, water level indicator, pins etc. to the toolkit more than provided to enrich the involvement of the participant in the 3D modelling process.	■	■	■		■			additional materials, involvement, 3D modelling, involvement
	Some teams used the sample toolkit that the researcher prepared as a reference while making their own toolkit.		■		■	■			sample toolkit
	Preparation of the toolkit helped the students to understand how to use the toolkit in the ERM sessions.							■	usage of toolkit, helping 3D modelling
	As laser cutter was used for some parts of the toolkit, the students experienced to use the faculty workshop and laser cutter as well.	■							using faculty workshop
diff.	Most of the teams found difficult to prepare the toolkits since the drawing file provided didn't explain how to match toolkit parts with the volumes, and the materials with the volumes in the toolkit.	■	■	■	■	■			drawing file, materials, matching parts
	One team found the dedicated time for the preparation of the toolkit too long.		■						time planning
	Rehearsal								
motivations	The rehearsal helped the teams to understand the use of toolkit in the ERM sessions.			■					usage of toolkit
	To understand and guide the participants, the teams modified the interview schedule after rehearsals.		■	■		■		■	modification in questions, interviewing, asking reasons, understanding participant
	The rehearsal phase enabled the students to think more flexible and unbiased, and to better understand the mind-set of the participants.	■			■		■	■	openness to participant
difficulties	Some teams just read the questions; therefore they had a collaboration problem among team members such as helping the participant for the 3D modelling process.	■					■		lack of rehearsal, collaboration, helping 3D modelling
	Some teams rehearsed the ERM session without using the toolkits; therefore they didn't realize how to use the toolkit in the sessions and how to help the participant for the 3D modelling process.			■	■				lack of toolkit, usage of toolkit, helping 3D modelling

Table 6.1 *Motivations and Difficulties during ERM preparation phase (Continued)*

	Recruitment	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
mot.	The teams tried to recruit experienced users since the experience of users affected the involvement in the session and 3D modelling process through enriching the information they gave.			■		■	■		experience of participant, involvement, detailed information
difficulties	As each team recruited only one participant for the ERM sessions, they might have difficulty in selecting appropriate one.		■						number of participant, selecting participant
	Recruiting only one participant for the ERM sessions affected the students' understanding of diverse user profiles.		■		■	■	■		number of participants, understanding diverse users
	Gathering information about the participant before the ERM sessions was critical since the teams might add new questions to the interview schedule to understand them more thoroughly.			■					information about participant, modification in questions, interview schedule
	Setting up ERM environment								
motivations	The environment that they arranged for the session and documentation of the session with video recorder gave the sense that the students were doing a professional task unlike previous research experiences. Hence, the teams and the participants were more concentrated and serious during the session.	■	■	■		■	■		professionalism, documentation, seriousness, concentration, session
	Arranging a specific environment for the sessions increased the concentration of the students and enabled the participant to feel more comfortable. That enabled the students to gain more information from the participant.		■		■				concentration, participant's comfort, detailed information
difficulties	Since the ERM sessions were held in the UTEST, the teams thought that the formal environment of the room and mirror glass disturbed the comfort and involvement of the participants.	■	■	■	■				formality, participant's comfort, involvement
	The ERM environment wasn't big enough for teamwork involving six students and a participant.		■			■			size of room, number of students
	Location of toolkit affected the visibility of the modelling area, the teams had difficulty in documentation	■				■			location of toolkit, visibility of modelling area, documentation
	Location of toolkit and modelling area affected the visibility of toolkit, so the students directed the participant.		■			■			location of modelling area, visibility of toolkit, directing participant, session

6.4.1.1 Introducing the ERM

Presentation explaining the teamwork needed. Before the ERM, the students were informed through a PowerPoint presentation explaining the ERM method and its phases, introducing the toolkit and the interview schedule, and giving examples from the pilot ERM session and analysis posters. Especially video clips in the presentation from the pilot ERM session that the researcher conducted beforehand were beneficial for the students in terms of understanding the means of conducting a session. However, the video clips were not enough to introduce the ERM session in two aspects. First one was introducing teamwork, and the second one was introducing interviewing technique. The duration of the videos was very short and they didn't give any information about how a team could work together collaboratively, since the researcher conducted the session individually. The students watched only some sections of the pilot ERM session which were about brewing tea (56 sec.), location of spout (48 sec.) and cleaning of tea maker (36 sec). It was difficult for the students to understand the details of the session by seeing only a part from the whole.

Effective mediums for the ERM analysis enabling personalization. Sample posters in the brief provided essential guidelines to describe the requirements of the analysis phase visually. The studio tutors encouraged the students to use them but also allowed to make changes on the format if they would like to. However, the students tended to use the samples as provided rather than developing totally different format. They did not want to make major changes as they thought the most appropriate format should be the one that the tutors developed. On the other hand, they became more motivated when they made some modifications through reflecting their creativity on the posters.

The first sample poster was more structured than the second one that it didn't enable the students to make changes on the format (Figure 6.11). It was text-based format which made it descriptive. However, there were so many texts that the students weren't willing to read all information on the posters. Some teams found it difficult to associate the insights with the corresponding images in the format. Even one team changed the format to link pictures and insights; it will be presented in detail at the first parts of the ERM analysis section.

Figure 6.11 Sample poster for the first part of the ERM analysis

For the sample poster II, there wasn’t a link between design solution areas and sketches, and there were not so many design solution areas related to more than one category. However, the idea generation phase appeared to be fruitful, as the students developed several design solution areas related to more than one design consideration. Although the students found difficult to relate their DSAs and sketches with design considerations, this enforced them to find other means of associating solutions visually and develop their own posters.

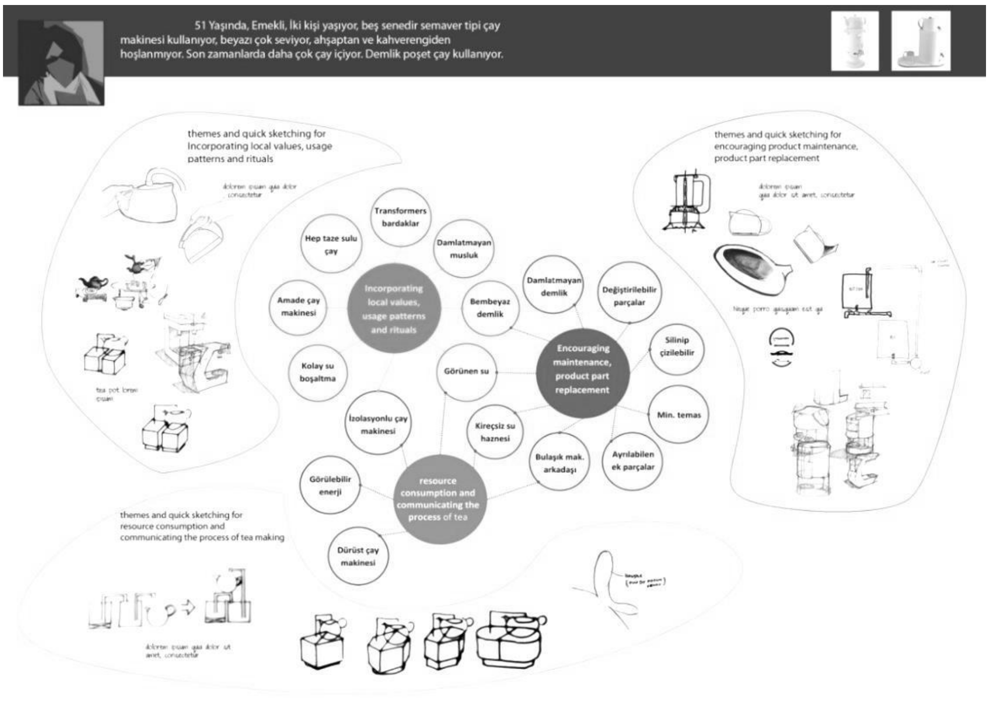


Figure 6.12 Sample poster for the second part of the ERM analysis

Definition of insights and DSA's needed. The ERM brief included those sample posters and comprehensive description of ERM and its phases. Although the brief stated the stages to be conducted during the phases, it didn't provide the definition of some terms in detail such as *insights* and *design solution areas*. As the students were novice researchers, they weren't sure how *interpretation* could be made and what the *potential design solution* meant. As there were not any examples for those, they tried to understand insights and design solutions areas by reading the texts on the sample posters provided for the ERM analysis.

6.4.1.2 Toolkit Preparation

The students prepared their ERM toolkits by using the drawing file provided. They had approximately one week to complete it from the introduction of the ERM to the ERM sessions. Since the teams completed their toolkits in advance, the dedicated time for it was mentioned as too long by one of the teams.

Disconnection between the surface developments and the 3D drawings. The drawing file was prepared on Rhinoceros, and included the 3D drawing and surface developments of the parts for laser cutter. There were also notes for additional materials such as Tack-it, play dough, wire, coloured papers, et cetera (Figure 6.13 & 6.14). The students were encouraged to use the laser cutter at the Faculty workshop to get them familiar with the facilities, and indeed there were still a few students who had never used the laser cutter before.

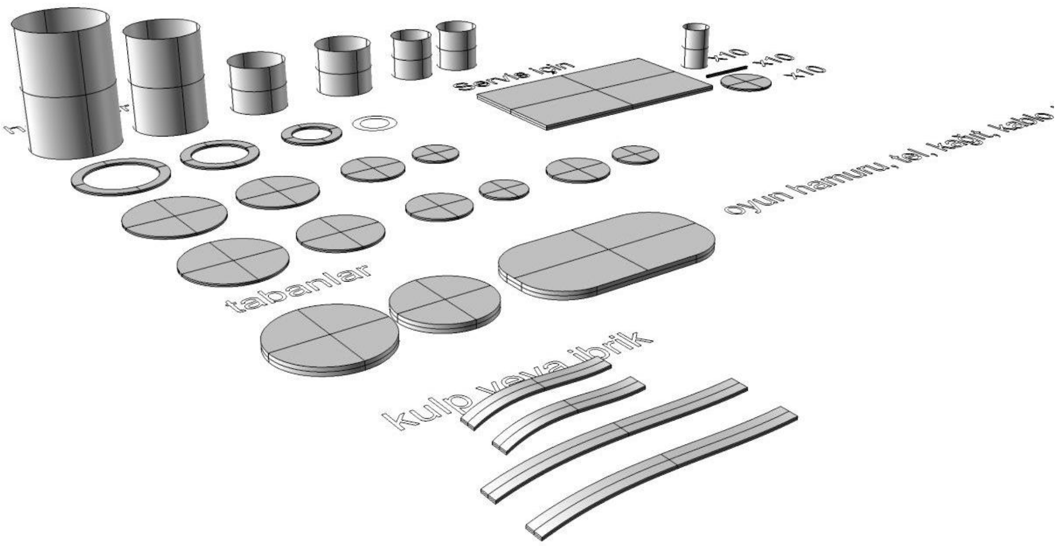


Figure 6.13 3D drawings of the parts in the toolkit

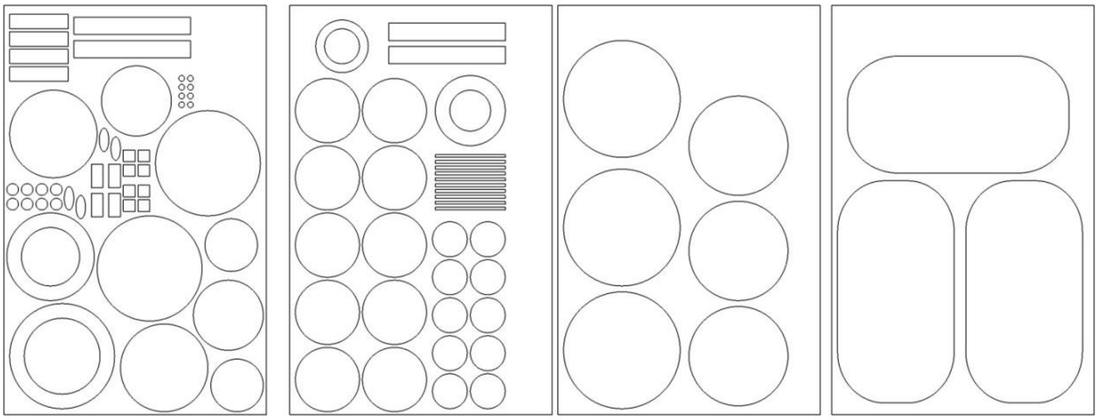


Figure 6.14 Surface developments of the parts in the toolkit prepared for laser cutter

Since there wasn't a connection between the surface developments and the 3D drawings in the drawing file, the teams had difficulty to match parts after they took developments from the laser cutter. They used the sample toolkit prepared by the researcher to complete their toolkits.

Enhancing modifications in the toolkit. The teams were allowed to add materials and parts to the toolkit. Most of the teams modified their toolkits slightly by adding parts and materials such as black cardboard, aluminium foil, materials representing tea and sugar, and water level indicators more than provided in order to enhance the 3D modelling experience of the participant (Figure 6.15).

The students had the chance to understand the usage of the toolkit while preparing it through thinking which parts in the toolkit could be the representation of which parts of a tea maker and serving set.

Figure 6.15 The toolkit of Team E

6.4.1.3 Rehearsal

Better planning for rehearsal needed. Rehearsal is essential to understand teamwork, toolkit and questions in interview schedule during ERM session. Lack of rehearsal can result in lack of collaboration in ERM session. However, the studio tutors didn't plan a scheduled program for the ERM rehearsal before the sessions. We encouraged them to rehearse in order to get familiar with the toolkit and the interview schedule. Some of the teams rehearsed only by reading the questions in the schedule. Some of the teams rehearsed without using the toolkit since they didn't want to wear it out. As a result, they had a collaboration problem in especially helping the participant throughout the 3D modelling process.

The teams had difficulties to guide the representative participants during the rehearsals. In order to cope with this difficulty, they took some precautions before the ERM sessions such as adding new questions prompting the participants or grouping the questions regarding the use phases such as tea brewing and serving. They also understood the importance of asking "why" after the participant's responses to understand her/him. During the rehearsals the teams also realized that some responses of the participants might not be in accord with their reasoning, because the participants didn't propose solutions from a designer's perspective. Rehearsal enabled the students to think more flexible and unbiased to understand the mind-set of the participants.

6.4.1.4 Recruiting Participant

Warming up participant before a generative session is critical for enhancing involvement of participant in session (Levitt & Richards, 2010; Sanders et al. 2010; Hanington, 2007). The students were required to recruit the participant that they had met before during the user observation since that participant was familiar with the project and primed by the user observation phase. Moreover, gathering information about the participants during the user observations enabled some teams to add questions to understand them more during the sessions. For instance, one participant had a child, and the team added questions about the safety issues considering the child.

As each team recruited only one participant, experience of the participant with tea making and serving became important, since it affected the involvement in the session and the 3D modelling process. The teams tried to take into account the experience of their participants to gather more detailed information from the session. However, it wasn't so easy to decide on the participant for some teams unless they conducted their user observations with an experienced user.

The students thought that conducting the ERM session with only one participant limited their understanding of diverse user profiles. However, it would be difficult to moderate more than one participant in a session since they were novice researchers. Instead, exchanging and sharing knowledge retrieved from each session among other teams would be more practical and efficient to understand diverse user profiles.

6.4.1.5 Setting up the ERM Environment

Setting a specific environment for the session made the students feel that they were conducting a professional study unlike previous research experiences. It was a motivation which increased concentration and comfort of the students and the participants. However UTEST environment was formal because of the mirror glass in the room giving the sense of being observed all the time (Figure 6.16).

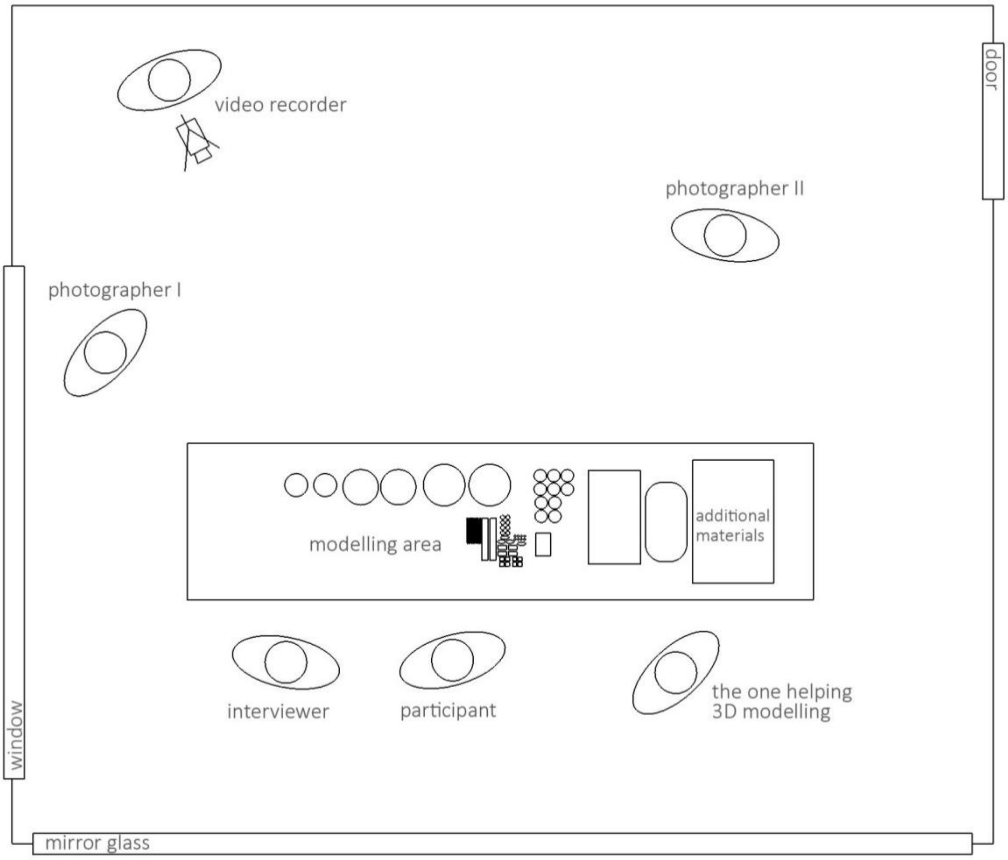


Figure 6.16 Schematic plan of the ERM environment

Visibility of the toolkit and the modelling area needed. On the other hand, location of the ERM toolkit specified location of the modelling area at the same time. Visibility of the toolkit and the modelling area affected both documentation and 3D modelling during the ERM session. The teams had difficulty in arranging the camera angle and taking pictures of the participant's modelling, since big parts in the toolkit hid the modelling area. Additionally, the students were not sure that the participant were seeing every part of the toolkit, thus they sometimes directed the participant to see and use the toolkit (Figure 6.16). Some teams consisted of six members, and the room wasn't big enough considering the number of students in the room.

6.4.2 The ERM Session

In the sessions, gathering as detailed information as from participants is very important for further phases of the ERM. There are many factors affecting the level of information retrieved from the sessions which are presented in detail in the following sections (Table 6.2). From a wider perspective, tangibility enabled by the 3D modelling, duration of the sessions, and tasks shared by the students in the sessions were some of the factors affecting the level of information. 3D modelling along with interviewing in the ERM sessions enabled the participants to talk more about the tea maker and tea experience that didn't come to their mind during the user observations, since the use contexts were realized out of borders of the existing products. That enabled the students to gain more information from the session unlike previous experiences. However, the participants still recalled their existing experiences and transfer positive features of their existing products to the 3D modelling while responding some questions. As a result, they remained loyal to their products to some extent in building up their 3D models. To reveal their latent needs, preferences and expectations beyond the final 3D models, the students should be aware of the participants' experiences with their existing products and should try to understand the reasons of their responses. The ERM sessions approximately lasted one hour. The students had never had the chance to talk with a participant so long. Thus, they gained more profound information about tea brewing and serving experiences. Another factor affecting the level of information gained from the sessions was the assigned tasks of the students. Each student was responsible for a particular task in the session. The interviewer and the student helping 3D modelling might be more focused on the responses of the participant to conduct the session by leading and prompting the participant. For instance, one of the students thought that if she/he had been an interviewer instead of a photographer, she/he would have been benefitted the session more.

On the other hand, the ERM session was the starting point of the idea generation phase. As the students got familiar with exploring ideas through reflecting on 3D modelling in their product design and development process, they started to find design solution areas in the session while the participants were building up their 3D models. That established a strong relationship between the ERM sessions and the analysis phase.

Table 6.2 *Motivations and Difficulties during the ERM Sessions*

	Session	A	B	C	D	E	F1	F2	Themes
motivations	3D modelling along with interviewing in the ERM sessions enabled the participants to give more information. That enabled the students to gain more information from the session.		■	■	■	■	■	■	tangibility, detailed information
	The duration of the sessions was long enough to gain more in-depth information.					■	■		session duration, detailed information
	While the participants reflected on the 3D models, the students started to find design solution areas in the session.		■						participant's reflection, DSAs
difficulties	As the participants recalled their experiences while responding some questions, they remained loyal to their existing product in building up their 3D models.		■		■	■			participant's experiences, influence by existing products
	The specific task assigned to each student (interviewer, photographer etc.) during the ERM session might affect the students' contribution to the sessions.						■		Tasks shared in session, students' utilization
	Documentation								
motivations	As the teams took adequate number of pictures during the ERM sessions, they didn't get difficulty in the preparation of the first analysis posters.		■	■	■	■	■	■	taking pictures, relating poster I
	Video recording the ERM session was essential for the analysis phase since the teams recalled the sessions by watching the videos.	■			■	■			video recording, recalling session, analysis
	The students felt more comfortable while taking pictures in the ERM session unlike previous research experiences conducted at domestic environments.	■							taking pictures, students' comfort
	Some phases of the ERM such as documentation, interviewing were similar to previous research experiences of the students. Hence, they could integrate their knowledge and abilities regarding those experiences into the ERM.		■	■	■	■			interviewing, similarity to previous experiences, integrating skills
difficulties	Documentation such as taking pictures and video recording might disturb the participants' comfort in the ERM sessions. There were especially two photographers in most of the teams in the ERM session; hence they thought that affected the participants' active involvement.	■		■		■		■	number of photographers, participant's comfort, involvement
	Some responses of the participant could not be reflected on the 3D modelling phase since the participants answered some questions only verbally. Hence, the students couldn't take pictures of some responses.	■	■	■	■	■			taking pictures, equivalency in 3D model
	The photographers had difficulty while taking pictures because they tried to keep clear of the video recorder.		■	■		■			taking pictures, video camera angle

Table 6.2 *Motivations and Difficulties during the ERM Sessions (Continued)*

	Interviewing	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
motivations	The participants gave more information that didn’t come to their minds because of the detailed interview schedule.	■	■	■		■	■		interview schedule, detailed information
	Some teams added new question to the interview schedule to better understand the user.	■					■		interview schedule, modifications in questions, understanding participant
	Some teams modified the questions in the interview schedule according to the participants' responses.				■	■			interview schedule, modifications in questions
	The teams guided the participants by prompts to encourage them to talk.					■	■	■	prompting, involvement
	Since the topics in the schedule were relevant to the Matrix exercise dimensions, the team used the outcomes of the ERM in the later stages of idea generation.						■		interview schedule, relevance to matrix dimensions, idea generation
difficulties	The participants responded some questions listed in the later parts of the interview schedule and the sequence of questions changed according to the responses of the participants. The teams might think that the questions were repetitive unless they followed the sequence of questions.	■	■			■	■	■	sequence of questions, sequence of responses
	Asking all the questions in the interview schedule was important to understand the tea making and serving experience thoroughly. It was difficult to ask and check the questions at the same time from the interview schedule in the ERM sessions.		■		■	■	■	■	interview schedule, checking questions, asking all questions
	The students found the language of the interview schedule was too formal for a daily life dialogue.		■					■	interview schedule, formal language
	Some teams didn't ask "why" question so often to understand the reasons of the participants' responses, therefore, it was difficult to make interpretations and the students were influenced by the participants' responses to a greater extent during the analysis phase.	■		■	■	■	■		understanding reasons, influence by participant, analysis
	Helping 3D modelling								
motivations	Diversity in the toolkit guided the participant and eased the 3D modelling process.		■		■				guiding participant, diversity in toolkit
	Helping the 3D modelling process effectively increased the active involvement of the participants.		■						involvement
	To guide the participant during 3D modelling process, the team added notes to some questions in the interview schedule such as leading the participant to the model.					■			guiding participant, interview schedule

Table 6.2 *Motivations and Difficulties during the ERM Sessions (Continued)*

	Helping 3D modelling	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
Difficulties	The tack-it wasn't found efficient to connect play dough with other parts, so it slowed down the pace of the 3D modelling process and decreased the involvement of the participant as well.	■		■		■	■	■	connector, pace of 3D modelling, involvement
Difficulties	Some teams thought every part in the toolkit substituted a particular part of an electric tea maker or serving set. Hence, they couldn't tailor the 3D model due to the needs of the participants.			■		■			toolkit, flexibility in toolkit
	Involvement								
motivations	The participants internalized the 3D models that they built up; since they felt like they were designing their own products. Thus, they gave more detailed information through exploring their 3D models.	■		■					internalization, detailed information
motivations	Since the questions in the interview schedule were relevant to her/his experiences, the participant felt comfortable during the session.	■							relevance to experiences, participant's comfort, involvement
motivations	Active involvement of the participants enabled the students to learn more from the session.	■							detailed information
motivations	Active involvement of the participants eased the process of finding insights and design solution areas for the ERM analysis. That also led the idea generation phase.	■	■	■		■	■		analysis, involvement, idea generation, analysis
motivations	Opportunity to make changes on the 3D model made the participant feel comfortable and increased their involvement in the sessions.		■	■				■	participant's comfort, changes on 3D model
motivations	Simplicity in the toolkit enabled the participant to feel comfortable and engaged the participant into the 3D modelling process.				■			■	simplicity in toolkit, participants' comfort, involvement
difficulties	The teams were not satisfied with the diversity of forms and volumes in the toolkit so this affected the involvement of the participants in reflecting on 3D models and the students' realization in terms of visual appearances.	■	■		■		■	■	toolkit, diversity in toolkit, participant's reflection, students' realization
difficulties	Some of the participants weren't so experienced in tea making and tea serving that their experiences affected their involvement in the ERM sessions and analysis phases as well.	■	■		■				experience of participant, analysis
difficulties	Giving information about the ERM session to the participants beforehand would have made them feel more comfortable and enriched their involvement in the ERM sessions.		■	■	■			■	informing participant, participant's comfort

Table 6.2 *Motivations and Difficulties during the ERM Sessions (Continued)*

	Relation in Interviewing & 3D Modelling	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
motivations	3D modelling along with interviewing in the ERM sessions supported interactions between the participants and the students. In this way the participant reflected on 3D modelling and the student realized what their participant talked about. This process made the analysis and idea generation phases easier.								tangibility, participant's reflection, students' realization, idea generation
	The participants reflected positive features of their existing products on the 3D model, so they built the model in between her/his existing and expected product.								exploration through modelling

6.4.2.1 Documentation

Documenting the ERM session with camera and video recorder is essential for the first part of analysis to recall the session, transcribe participant's statements, and relate those statements with corresponding images. Almost all of the teams took adequate number of pictures during the ERM sessions, because they were familiar with documentation process from their previous research experiences. They had the chance to integrate their knowledge and abilities about documentation; hence they didn't get difficulty in the preparation of the first analysis posters. However, some responses of the participants didn't have any equivalency in the 3D models, since the participants answered some questions only verbally. Since the students couldn't take pictures of some responses, they tried to pick the most relevant ones for their first posters. Another difficulty while taking pictures of the session was keeping clear of the video recorder. The photographers couldn't take pictures of the participant and the modelling area easily in order to not to stand in front of the video recorder (Figure 6.16).

Students may feel uncomfortable while taking pictures of participants during research. Participants might be reluctant to be photographed at their homes. However in the ERM sessions, the students felt more comfortable than the previous research experiences in terms of documentation because of the professional environment of the sessions. On the other hand, the students thought that they disturbed the participants' comfort and active involvement as well, since there were two photographers in most of the teams in the ERM sessions.

6.4.2.2 Interviewing

Conducting interviewing phase efficiently to understand the experience of participants depends on the coverage of topics in the interview schedule and the skills of interviewer. The questions in the ERM interview schedule were based on use process and lifespan of a product which the participants had experienced before such as preparation for tea making, brewing, serving, energy consumption, cleaning, maintenance, repair, and so on. Those questions were also in line with the sustainable design considerations in the project brief so that the students were able to use the outcomes of the ERM at the idea generation phase. Not only the content of questions is not enough solely, but also communication and interview skills of the interviewer are important to guide the participant and gather as detailed information as possible.

Interview schedule supporting effective way of communication needed. Although the students had experienced interview process before, that was the first time with such a detailed schedule. It was challenging to handle so many questions and ask all of them. Sequence of the responses may not pursue sequence of the question. In that case, the interviewer requires following the responses so she/he avoids asking the questions that are answered in order to prevent repetition. The interviewer needs to listen the participant with patience to prompt for encouraging her/him, modify the questions or even add new questions according to the responses. For instance, Team A added new questions during the session according to their curiosity and the participant's responses such as "Would you like a full automatic tea maker, does it disturb you, does it changes the taste of tea?" or 'Do you have a child, If you have, does she/he use the tea maker and how?"

Asking "Why?" to understand the reasons of participants' responses is critical for the further phases of the ERM especially to gain insights. Since students are novice researchers, they can skip this question. The importance of understanding the reasons of participant should be explained to students, otherwise students might stumble in developing design solution areas in line with participant's solutions rather than in line with participant's expectations, needs and experiences through understanding their reasons.

Most of the teams read the introduction part and questions from the interview schedule and they found that the language of the interview schedule was too formal for a daily life dialogue. As it was impossible to memorize all information and questions in the interview schedule, the rehearsal phase gained importance in terms of comprehending the essence of the interview schedule and conducting the interviews in a more naturel way.

6.4.2.3 Helping 3D Modelling Process

During the ERM sessions, the participants were willing to engage with the toolkit by themselves; however a student for each team helped the participant when she/he asked for help. It eased the modelling process and enabled the participants to focus on the sessions.

More effective means of connecting parts needed. The importance of rehearsal for the efficiency of helping 3D modelling was explained in the previous sections. Another factor affecting this process is the components in the ERM toolkit. The toolkit composed of various parts and materials from simple abstract shapes to additional materials such as play dough, fabric, papers, and so on. Diversity in the ERM toolkit enabled the students to guide and help the participants easily. However, the material used to connect the parts in the toolkit (i.e. Tack-it, Blu-tack, etc.) was not found efficient enough to stick together play dough with other parts, because play dough was too heavy for it. Therefore, the pace of the 3D modelling process and involvement of the participant were decreased concurrently.

Besides, the parts in the toolkit were flexible to be tailored to the needs of the participants. However, some teams thought every part in the toolkit substituted a particular part of an electric tea maker or serving set, and these were used as they were. Even a team wrote down the names of each part such as trays, spoons, handles, bases etc. before the session (Figure 6.17). The students might be confused about that, since the parts in the drawing file of the ERM toolkit were labelled in the same manner. The aim of labelling parts in the drawing file was to help the students understand which parts were developed based on which parts of an electric tea maker and serving set, but the students and participant weren't limited with those labels during the sessions. This should have been clarified to eliminate confusion.

Figure 6.17 The toolkit of Team C

The interview schedule should be clear enough in which questions the students lead the participant to the toolkit. Although there was a star (*) in front of the questions indicating required help for the modelling process, a team added notes to some questions in the interview schedule such as “direct the participant to the model.”

6.4.2.4 Participant’s Involvement, and Relation between 3D Modelling and Interviewing

Active involvement of the participants in the ERM sessions means involvement of them while building up 3D models at the same time responding the questions. 3D modelling along with interviewing in the ERM sessions provided interactions between the participants and the students. In this way, the participant reflected on 3D modelling by experiencing in the use context, and the student envisioned what their participant talked about (Figure 6.18). This tangible process made the analysis and idea generation phases easier.

Figure 6.18 The participants were reflecting by experiencing in the use context

Involvement of the participant was related with many phases as explained before. Besides, it was mainly affected by the ERM toolkit, the 3D modelling process and the interview schedule. Simple abstract shapes in the toolkit helped the participant feel more comfortable in the 3D modelling process independent of their personal skills on model making. Simplicity in the toolkit enabled the participant to involve actively in the modelling process. Moreover, opportunity to make changes on the 3D model made the participant feel comfortable and increased their involvement in the sessions. Changes on their 3D model by exploring through modelling helped them to reflect positive features of their existing products on the 3D model, so they built the models in between their existing and expected products. Simplicity and flexibility in the toolkit enabled the participants to internalize the 3D models that they built up, thus they gave more detailed information through engaging with the toolkit and exploring through modelling.

Need for personalising the toolkit. On the other hand, the students mentioned that simplicity in the toolkit confronted diversity in the toolkit. They weren't satisfied with the diversity of forms and volumes since it affected the involvement of the participants in the reflection on the 3D models and the students' realization in terms of visual appearances. For some cases, the students couldn't meet the needs of the participants by using the toolkit provided, although the toolkit was flexible to be tailored to the specific needs of the participants. As mentioned in the helping 3D modelling process section, that seems to be critical issue. The simplicity in the diversity should be provided in the toolkit in order to enrich the involvement of the participant as well as the realization of the students.

Other factors affecting the involvement of the participant were experiences of the participants with tea making and serving, relevancy of the questions with those experiences, and informing the participants about the ERM sessions. The questions in the interview schedule were relevant to the participants' experiences, and they felt comfortable while responding the questions. However, some of the participants weren't so experienced in some stages of tea making and tea serving so they couldn't give detailed responses for some of the questions.

Need for priming the participants for the ERM. The participants weren't informed in detail before the sessions, even some of the participant didn't know about what they would do in the sessions. Giving information about the ERM session to the participants beforehand would have made them feel more comfortable, and enriched their involvement in the ERM sessions.

The analysis part of the ERM was affected by the level of involvement, and relation between the 3D modelling and the interviewing phases in the ERM sessions. Active involvement of the participants enabled the students to learn more from the session, and to develop insights and design solution areas easily for the ERM analysis. Hence, the students were well equipped in the idea generation phase.

6.4.3 Analysis

The analysis part of the ERM composed of two parts. It was mainly aimed an overall comprehension of interpretations in the first part, and in the second part, it was mainly aimed an analysis of relations between interpretations and design considerations, and synthesis of the knowledge retrieved from the sessions for the idea generation phase. The phases of the

ERM analysis were following a logical order based on skills for critical thinking of students in the cognitive domain (Bloom, 1956). For each phase of the ERM analysis, the outcomes were supported by the corresponding images or sketches to enhance creativity of the students, and to enable them to bridge generative research with idea generation phases. The ERM analysis was more visual-based than other research experiences that the students had conducted before.

Teamwork in the ERM analysis had both advantages and disadvantages. It enabled the students to explore and understand different points of view of the team members, and increased their creativity in the analysis phase. On the other hand, the teams made a division of labour which decreased workload. Some students didn't participate in all phases of the ERM analysis; as a result, each student was not quite aware what other members of the team did.

Not only the ERM analysis, but also the sessions led the students to the idea generation phase. They started to analyse in the ERM sessions and they recalled the sessions during the ERM analysis. However, they weren't sure to what extent they could integrate their personal ideas and experiences into the participant's ideas mentioned during the ERM analysis.

Through the ERM analysis, the students learned to categorize and assess the whole data, and to compile the knowledge for developing design solutions. They mentioned that they can adapt this technique to any kind of user research (e.g. user observation, interviewing, etc.) in future projects. Details of the first and second part will be presented in the following section based on the motivations and difficulties encountered during these phases (Table 6.3 & Table 6.4)

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Table 6.3 *Motivations and difficulties during the ERM analysis and the first part of it*

ANALYSIS

	Analysis	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
motivations	The analysis phase of the ERM was creative and enjoyable, since it was more visual-based than other research experiences.		■			■		■	visual-based format, creativity
	The sequence of analysis phase was easy to follow for the students.		■	■					sequence of analysis, ease of following
	The ERM sessions remained in the students' minds, and they recalled the sessions while analysing.				■	■			recalling session
	Teamwork enabled the students to explore different points of view and increased their creativity in the analysis phase.				■	■			teamwork, diversity in ideas, creativity
	The team learned to categorize and assess the whole data during analysis that they were willing to adapt into future projects.						■		adaptation in future
	The team took into account of the outcomes of the analysis during the Matrix exercise.					■			idea generation
difficulties	The students didn't participate in all phases of the first part of the analysis, as they made a division of labour. Therefore, each student was not quite aware what the others did.	■	■	■		■	■	■	division of labour, awareness of other members
	The teams thought that they weren't creative enough in finding novel ideas and couldn't integrate their opinions to a greater extent, since they adopted the participants' solutions that they mentioned during the ERM sessions.	■		■	■				integrating personal knowledge, influence by participant
	Part I								
mot.	As the students worked in teams, the dedicated time for the first posters was adequate for preparation			■			■		time planning, teamwork
	First posters enabled the teams to see the other team members' opinions.			■					diversity in ideas, teamwork
	The team benefitted from the first poster during idea generation phase.					■			idea generation
	Transcription								
mot.	Working in teams and dividing the tasks eased the transcription phase.	■		■					teamwork, division of labour
	Recording and transcribing full statements of the participants enabled the students to understand them more thoroughly.					■			understanding participant

Table 6.3 *Motivations and difficulties during the ERM analysis and the first part of it (Continued)*

	Transcription	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
difficulties	Full translation of the quotations and forming sentences in English were difficult for the students.	■		■					translation
difficulties	The teams had difficulty in selecting the significant parts from the whole ERM sessions. One student from one of the team took notes to ease the selection process for the transcription.	■	■		■				selecting quotes
difficulties	The length of quotes was too long to read and organize in the first poster.	■		■	■	■	■	■	length of quotes, ease of reading, organizing materials
difficulties	As the participants didn't complete some of their sentences verbally, the teams added words to the participant's quotes to make them readable.	■	■		■			■	completing sentences
difficulties	The participants talked about the same topic at different times, so it was challenging to gather relevant quotes from different timeslots of the videos.		■	■		■			gathering relevant quotes
difficulties	As the teams made full transcription of selected quotes, they found this phase exhausting.			■				■	workload
	Insights								
motivations	Insights were easier to read than quotations since they were shorter and more descriptive.	■							ease of reading
motivations	The sequence of insights and design solution areas were easy to proceed, since the team didn't need to return to quotes after gaining insights and developing design solution areas.	■							DSAs, ease of following
motivations	Working as teams enabled the students to discuss for gaining insights and to be aware of each other's ideas.		■		■	■			awareness of ideas, teamwork
motivations	The interpretation of the participants' statements helped the students better understand the participants and encouraged them during the idea generation phase.			■					understanding participant, idea generation
dif.	The teams believed that the more information about the participant they gathered, the easier they understood why the participants said so.			■	■	■	■		insights - information about participant
	Design Solution Areas (DSAs)								
motivations	Design solution areas were easier to read than quotations since they were shorter and descriptive.	■							ease of reading
motivations	The teams developed the design solution areas individually through discussions. Hence, they collected diverse ideas which encouraged defining problems for the idea generation phase.		■	■					individual work, diversity in ideas, idea generation
motivations	The content of design solution areas were conceptual and open ended that made them enjoyable.			■		■			thematic content
motivations	The teams had the chance to add their personal experiences and results of user observations to their design solution areas.				■			■	integrating personal knowledge, integrating user observations
motivations	The team used other team's insights as well while developing the DSAs.						■		awareness of other teams

Table 6.3 *Motivations and difficulties during the ERM analysis and the first part of it (Continued)*

	Design Solution Areas (DSAs)	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
difficulties	The students wished to have more time for developing design solution areas	■					■		time planning
	The teams tried to explain their design solution areas in a few words, hence some of them thought that this diminished the richness, and thus generalized the content of the insights.		■						generalization of content
	There was a gap between design solution areas and categorization, since insights were developed independent from three main design considerations.				■				irrelevant DSAs, categorization
	Relating in the Poster I								
motivations	The team made a division of labour for the first poster such as selection of pictures, organizing materials, etc.		■						teamwork
	The team modified the layout of the first poster to make it more readable.					■			modification, ease of reading
	Some teams grouped the quotes such as cleaning, ergonomics etc. to make them easy to read and to discuss them further, which eased the insight gaining phase.		■			■			modification, insights, ease of reading, transcription
difficulties	Preparing the first posters in two languages made the poster too crowded to organize.		■						text-based format, organizing materials
	The teams didn't prefer to make their first posters by collage technique, since it was difficult to organize materials.	■	■	■	■				collage, organizing materials

6.4.3.1 Analysis Part I

The first part of the ERM analysis lasted approximately one week from the end of the ERM sessions to the beginning of the second part of the analysis. As the teams made a division of labour for each phase of the first part, the time dedicated for the first posters was adequate for the preparation. The first part of the analysis was the first time for the teams that they started to discuss their opinions about the outcomes of the ERM. They broadened their perspectives and tried to understand each other's viewpoints. During the idea generation phase, the students utilized the first posters in addition the second posters to understand the origins of the design solution areas and ideas.

6.4.3.1.1 Transcription

Taping full quotations was essential to understand the participant more thoroughly and to share them with other teams. Thus, the students were required to write down all of the selected quotations of the participant both in Turkish and in English. Because of the nature of transcription, the teams had difficulties such as verbatim-transcription, completing sentences to make them readable, selection of important quotes for the project, bringing together the relevant quotes.

The first task in the transcription was selecting the significant quotes for the project from the whole session. Most of the teams divided the video recording into pieces and each student was responsible for a particular timeslot. However, the participants talked about the same topic at different times, so it was challenging to gather relevant quotes from different timeslots of the video recordings.

During the sessions, the participants didn't complete some of their sentences verbally, so the students checked the video recording several times to add the corresponding words to the participant's quotes to make them readable. After completing the sentences, they were required to translate them in English.

Less time consuming and more effective ways of data analysis needed. After transcribing and translating the quotes, the teams had a vast amount of materials to organize in the first poster. Almost all of the teams thought that the quotations were too long to read and they weren't catchy enough for attracting the attention of the students.

6.4.3.1.2 Insight Gaining and Developing DSAs

Insights and design solution areas were easier to read than quotations, since they were shorter and more descriptive. Insights were the statements explaining the students' interpretation of the participants' statements. This helped them understand the participants and encouraged the idea generation phase. The teams believed that if they had gathered more information about the participant, they would have understood their participants' statements easier.

Design solution areas (DSAs) were thematic keywords in response to insights having the potential to be developed as design solutions. The content of design solution areas appeared to be more conceptual and open-ended which had the potential to inspire the ideas, and the teams enjoyed while developing DSAs. On the other hand, if the content of DSAs were too general and vague such as “user friendly tea maker” or “energy efficient tea maker”, those keywords would diminish the richness of insights.

Approaches of the teams for gaining insights and developing design solution area were different from each other. The teams tried to reach an agreement for insights through discussions so that they would be aware of each other’s opinions anhd comments. However, they developed design solution areas individually, hence, they collected diverse ideas on the same insights defining problems for the idea generation phase. By this way, they had the chance to integrate both their personal experiences and the results of user observations into their design solution areas. During this phase, they had also the chance to use other team’s insights. Design solution areas became the integration of various source of knowledge (i.e. their and other teams’ ERM sessions, personal experiences, user observations) while insights were only the interpretations of each teams’ participants’ statements.

The route starting from quotations and continuing with design solution areas were easy to proceed. Hence, the teams didn’t always need to return to quotes after gaining insights and developing design solution areas for the idea generation phase. However, the categorization phase was out of this route, since insights and design solution areas were developed independent from three main design considerations in the project brief. So, there was a gap between design solution areas and categorization.

Since insights and DSAs were following each other, some students couldn’t manage the time dedicated to the first posters. They spent too much time for gaining insights. Therefore, they had limited time for the development of design solution areas.

6.4.3.1.3 Relating in the Poster I

Collage enables students to work together and to discuss while preparing posters. However, it might be difficult and time consuming unless all materials for the posters are ready. The teams weren’t asked to prepare their selected quotations before they started their first posters. The studio tutors encouraged the students to use collage technique for the preparation of the ERM analysis poster I. However, some teams asked for using digital environment, and then the studio tutors let the teams use any technique that they wanted. Most of the teams didn’t prefer to make their first posters by collage technique since it was difficult to organize materials. Since preparing the first posters in two languages made the poster too crowded to organize, the teams except two teams needed to prepare two posters for the first part of the ERM analysis. Whether the teams prepared their posters by collage technique or digital environment, they made a division of labour such as taping quotes, selection of pictures, organizing materials, et cetera.

As mentioned in the transcription section, the first posters were text-based, and they weren’t easy to read. Therefore, some students made adjustment on the sample format for the first poster. One of the teams modified the layout of the first poster in a way that they related the insights with pictures by writing the insights under corresponding pictures (Figure 6.19).

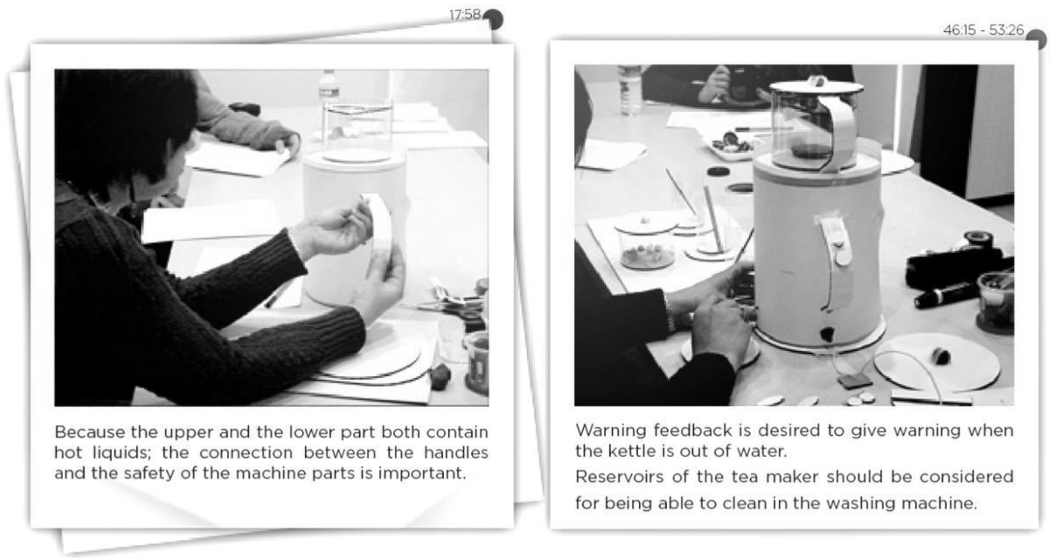


Figure 6.19 Adaptation of the first sample poster prepared by Team E

Additionally, two teams grouped the quotes under particular topics such as cleaning, ergonomics etc. to make them easy to read and to discuss them further. They mentioned that grouping the quotes contributed to the insight gaining phase.

6.4.3.2 Analysis Part II

Some of the factors affecting the motivation of the students in the second part of the ERM analysis were teamwork and development of diverse ideas for the project. Working as a team enabled the students to develop as diverse ideas as possible during the second part of the ERM analysis.

All of the teams started to work on their second posters at the same day with the submission. Most of the teams couldn’t start till afternoon, since they were still dealing with the first part of the analysis. Although preparing the second part of the analysis at the studio hours made them feel comfortable, allocated time for the second poster was considered as limited for some teams. Hence, those teams couldn't elaborate on each design solution area. Yet, the second part of the analysis was important to link the research part to the idea generation phase.

To what extent the students have benefitted from the outcomes of the ERM at the idea generation exercise the Matrix (Korkut & Dogan, 2010) will be explained in the following sections. In the Matrix, the students were required to relate a project dimension with a project theme, and generated ideas which compiled themes and dimensions. One of the drawbacks that the students mentioned was the difference in the format of the second ERM poster and the Matrix. Techniques used in the second ERM poster and the Matrix exercise were also different from each other. In the ERM poster, the students were free to generate design ideas according to the solution areas that they developed. However, in the Matrix exercise, they were required to generate ideas based on a combination of predefined project themes and a project dimensions. While the aim of the second part of the ERM was visualizing the outcomes of the ERM and initiating the ideas related with the project through quick sketching, the aim of the Matrix was generating diverse design ideas by encouraging the students' creativity by making them compile project themes and project dimensions. However, some of the students believed that the difference in the formats of two exercises somehow prevented them using the outcomes of the ERM in the Matrix exercise.

Table 6.4 *Motivations and difficulties in the second part of the ERM analysis*

	Part II	A	B	C	D	E	F1	F2	Themes
mot.	Preparation of second posters was enjoyable, since the students worked in teams and created diverse ideas.		■	■				■	diversity in ideas, teamwork
	The teams felt comfortable as they prepared their second posters during the studio hours.			■		■		■	studio hours
difficulties	Dedicated time for the second poster was limited, therefore the teams couldn't elaborate on each design solution areas that would be the initiation for the idea generation phase.				■	■	■	■	time planning, idea generation
	There was a gap between the second posters and the Matrix exercise since the techniques and the presentation format used were different from each other.					■			format, gap between part II & idea generation
	Categorization								
motivations	The categories were so broad that they could relate them with design solution areas.		■	■	■	■			categories, clarity
	The team worked together through discussing on categorization.			■					teamwork
	Grouping design solution areas under categories helped the students generate ideas regarding design considerations of the project.		■			■			relevance to project considerations, idea generation
difficulties	The teams thought that the content of categories were so broad and overlapping with each other. Hence, there were DSAs and sketches related to more than one category making them difficult to relate in the second posters.	■	■	■	■	■	■		intersecting categories, associating DSAs with sketches
	Some design solutions of the teams weren't related with any category, so there was an accumulation in the most related category.	■	■	■	■	■	■	■	irrelevant DSAs, associating DSAs with sketches
	Some categories weren't clear enough in the ERM brief such as 'communicating the process of tea making'.	■		■		■			brief, clarity

Table 6.4 *Motivations and difficulties in the second part of the ERM analysis (Continued)*

	Sketching	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
motivations	The teams made sketches individually, so they developed diverse ideas by adding their personal reflections.	■	■		■	■	■	■	individual work, diversity in ideas, integrating personal knowledge
	Sketches were easier to read than quotations, since they were visual.	■							visual-based format, ease of reading
	Sketching filled the gap between user research and idea generation phases through enabling the students to synthesize their ideas emerged through the ERM results.		■	■		■			integrating personal knowledge, bridge between research & idea generation
	Discussing the DSAs during sketching enabled the student teams to develop diverse ideas.	■			■				diversity in ideas
	Sketches in the second posters were initial stage which encouraged exploration rather than detailing of ideas.			■			■	■	level of sketches, diversity in ideas
	The session remained in the students' minds and the team recalled the session while sketching.	■	■				■		recalling session
difficulties	The teams thought that the dedicated time for sketching wasn't enough considering the amount of sketches expected.	■		■		■	■		time planning, amount of sketches
	Some teams weren't sure about the quality and the amount of the sketches expected in the second posters.			■	■				clarity, brief
	There was a lack of technical knowledge that affected the content of sketches.				■				lack of technical knowledge

Table 6.4 *Motivations and difficulties in the second part of the ERM analysis (Continued)*

	Relating in the Poster II	**A**	**B**	**C**	**D**	**E**	**F1**	**F2**	**Themes**
mot.	The sample poster II provided the teams flexibility to personalize their posters through modifying their second poster especially by means of relating design solution areas with sketches.	■	■	■	■	■	■	■	modification, sample poster II, introducing, diversity in posters
dif.	The size of texts was too big in the sample poster II, the students wished to have more space for sketches.			■		■			space for sketches
	Sharing								
motivations	Sharing the analysis posters at the design studio made the students aware of what the other teams did. That made the distinct and common ideas visible and the students had the chance to compare their ideas with each other.	■		■	■	■	■		awareness of other teams
motivations	Sharing second analysis posters was a bridge between research and the Matrix exercise. The teams had a voice for the development of the Matrix exercise by selecting favourite DSAs.		■	■				■	favourite selection, bridge btw research & idea generation
motivations	The team utilized from other posters during matrix exercise, since they were shared at the studio.					■			awareness of other teams
motivations	Sharing the analysis posters at the design studio enabled the students to understand other teams' participants in other words diverse user profiles and to converge ideas for the idea generation phase.			■	■				understanding diverse users, idea generation
	Sharing								
difficulties	Some students found difficult to relate sketches with categories in the other teams' posters, each team organized the second posters differently.	■		■					associating sketches with categories, modification
difficulties	The teams focused on their participants during the analysis phase, and there weren't an interaction and idea exchange between the teams to discuss and understand diverse user profiles except hanging posters on the walls at the studio.	■	■	■		■		■	lack of interaction, understanding diverse users
difficulties	The teams were reluctant to review all posters and select favourites because they were tired at the end of the day, and there was a crowd due to the time limitation.	■	■	■		■	■		favourite selection, crowd, time planning
difficulties	The students wished to watch other teams' sessions to understand diverse user profiles.		■	■	■		■		watching other sessions, understanding diverse users
difficulties	Some students wished to rate ideas in the second poster of each team to make outstanding ideas visible.				■			■	lack of rating

6.4.3.2.1 Categorization

Grouping the potential design solution areas under the categories such as incorporating local values, usage patterns and rituals, encouraging product maintenance and product part replacement, and understanding resource consumption patterns and communicating the process of tea making helped the students generate ideas regarding the sustainable design considerations of the project. Content of the categories were so extensive which enabled the teams to easily relate them to the design solution areas; however extensiveness of the categories resulted in relating a lot of design solution areas and sketches with more than one category. It was difficulty to distinctly separate some of categories such as incorporating local values, usage patterns and rituals, and communicating the process of tea making. Those two considerations were both about use experiences on tea making. Thus, the students had difficulty to associate them visually in the second posters.

Better means of relating sketches and DSAs with project considerations. On the other hand, some design solutions of the teams weren't related with any category, since they developed their design solution areas independent from the design considerations. There was an accumulation in the most related category in the second posters. Apart from that, Team A created their own categories to relate them with the provided design considerations. They believed that they created sub-categories in relation to the provided such as aesthetics and taste under incorporation local values, usage patterns and rituals (Figure 6.20).

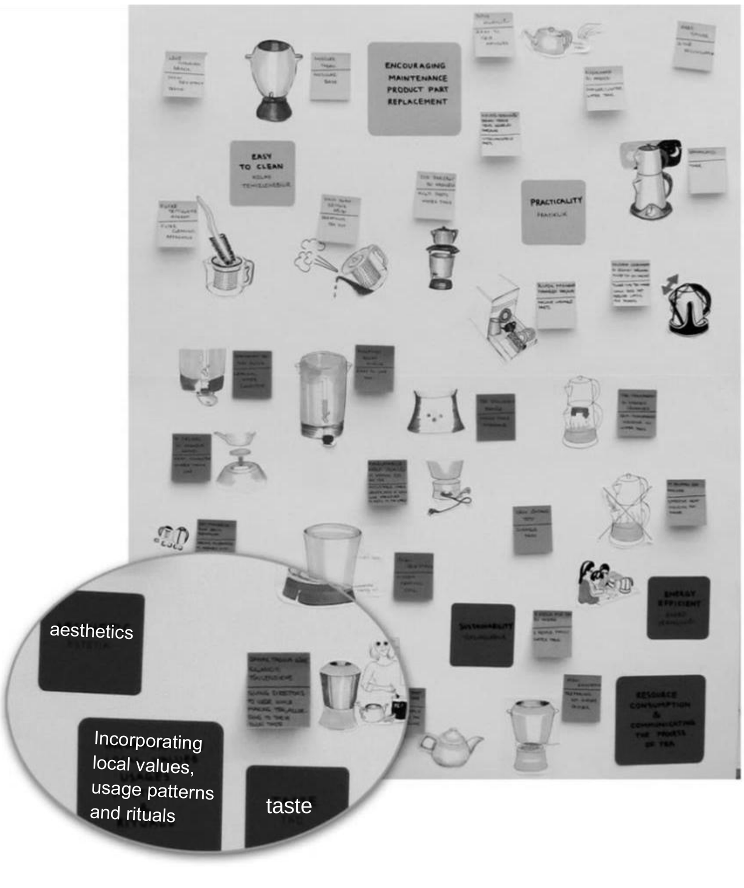


Figure 6.20 ERM analysis poster II of Team A

6.4.3.2.2 Sketching

Sketching was a visual medium to link user research with idea generation phase through enabling the students to synthesize their ideas with the ERM results. They had the opportunity to show their personal skills and creativity. On the other hand, discussion in the team was a challenge forcing the students to think more thoroughly, although they sketched individually.

Sketches in the second posters were initial level which encouraged exploration rather than detailing of ideas. However, each student approached differently as they weren't sure about the quality and the amount of sketches expected in the second posters. While some of the students remained at the very conceptual level, some of the students went into product details in their sketches (Figure 6.21). For both cases, the students didn't take into consideration technical details, since technical information about a tea maker were given to the students after the ERM.

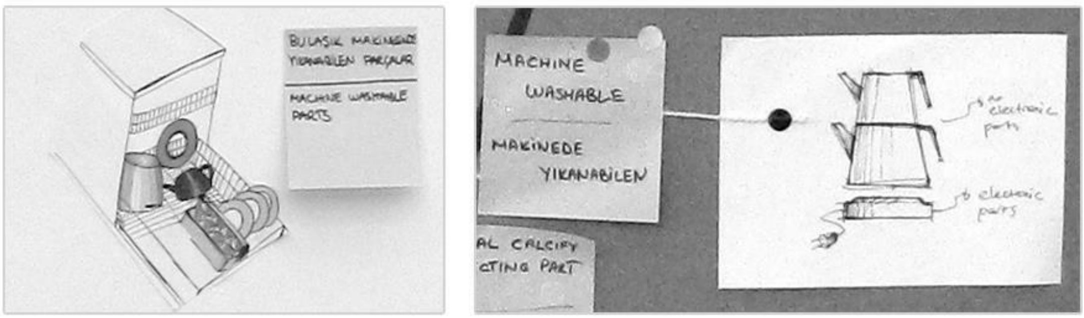


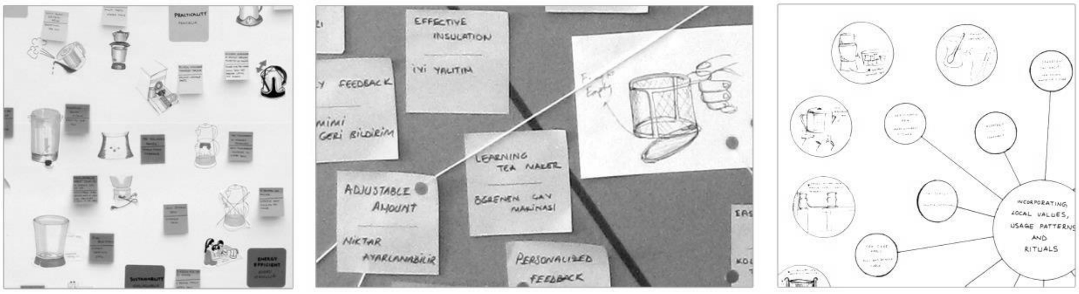
Figure 6.21 Different approaches to machine washable design solution area, from left to right, Team A, Team B

Each team couldn't dedicate adequate time for this phase as they spent so much time for the previous phases of the ERM analysis. They thought that allocated time for sketching wasn't enough considering the amount of sketches expected.

6.4.3.2.3 Relating in the Poster II

The second sample poster provided flexibility, so the teams created their own poster. The teams modified their second poster especially through relating the design solution areas with the sketches. As mentioned in the categorization section, the team had to modify their second posters to relate visually design solution areas and sketches with the design considerations. That enabled diversity in the second posters. They achieved that by (Figure 6.22):

- colour coding to associate DSAs and sketches with relevant design consideration (a)
- using robes and lines for connecting relevant DSAs, sketches, and considerations (b)
- visually locating relevant sketches nearby design solution areas and considerations (c)



a. colour coding (Team A) b. robes and lines (Team B) c. locating (Team E)

Figure 6.22 Different approaches to organize the materials in the second posters

On the other hand, some of the students mentioned that size of texts was too big in the sample poster II; they wished to have more space for sketches.

6.4.3.2.4 Sharing

All analysis posters were shared in the design studio at the end of the ERM analysis. All students were supposed to review all ideas and to select their favourite design solutions based on three project design considerations. By this way, it was aimed to

- make distinct and common ideas visible and make the students to compare their ideas with each other's;
- enable the students to understand diverse user profiles and to synthesize the outcomes of the ERM for the idea generation phase;
- bridge the research and the Matrix exercise by developing themes and dimension based on the selected DSAs;
- enable the students to get benefit from other posters during the Matrix exercise.

Better means of sharing needed. There were some obstacles for the teams about sharing phase such as lack of interaction, difficulty in understanding other teams' DSAs, crowded studio environment, time limitation et cetera. Sharing phase was the first time that the students were aware of what each team did during the ERM. The teams focused on only their participants during the analysis phase, and there was not an interaction and idea exchange between the teams to discuss and understand diverse user profiles except during the phase of hanging posters on the walls at the studio. Additionally, they didn't see other teams' sessions, so they mentioned that they would have seen the ERM sessions to understand diverse user profiles.

Some of the students had difficulty to understand the basis of the DSAs, since each team organized the second posters differently, and they couldn't review all posters so thoroughly because of time limitation and crowd in the studio.

In the previous implementation of the ERM in the mini oven project, the students rated the analysis to make outstanding ideas visible. Some student wished to rate the design solution areas in this phase of the ERM.

Working with an everyday life people enabled the students to understand user experiences, expectations and needs, and made the problems explicit for the idea generation phase. From the introduction to the analysis of the ERM, the sequence of the phases conveyed the students to the idea generation phase sequentially, since the phases was relevant to each other. The students had the chance to converge their knowledge about tea brewing and tea serving experiences with the participant's one through ERM analysis. In the next section, the influence of the ERM in the idea generation phase will be discussed with examples.

6.5 The ERM for Idea Generation

After the ERM, the teams completed an idea generation exercise namely the Matrix (Korkut & Dogan, 2010). The Matrix idea generation exercise was incorporated into various educational cases in the third year industrial design studio at METU so far. In this educational case, the exercise was also implemented to encourage the students to develop diverse ideas based on project dimensions and themes after the ERM. In this exercise, the students were required to relate a project dimension such as engaging, adjustable, personalized with a project theme such as drip minister, resource activist, etc., and to develope ideas which brought together themes and dimensions. The project themes and dimensions except one dimension were predetermined by the studio tutors in accord with the students' favourite design solution areas that the students selected after the ERM analysis. The student teams determined one dimension by themselves.

This section presents the implications of the ERM findings for the following idea generation phase of the project, the Matrix. The examples presented in this section are the ones that the students have explicitly stated that they have been inspired by the ERM analysis poster. All of the teams mentioned that they were inspired by the ERM directly or unconsciously during the Matrix exercise.

In Figure 6.23, on the left side, the participant of Team A was concerned about the overweight of the water tank, and said that it was difficult to hold the water tank while pouring water. As a response to the participant's concern, the team focused on the idea of a water tank which didn't require lifting for pouring water. After they generated this idea, they realized that both water tank and tea pot might not be lifted during serving and they came up with the idea that a tea maker as a part of a table. They fixed the tea maker on a table, since they thought that many people drank tea after dinner.

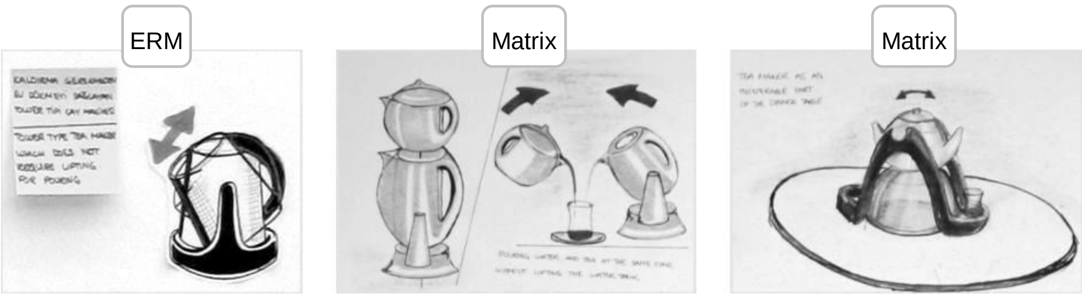


Figure 6.23 The process of the inspiration of Team A from the ERM analysis in the idea generation

In this example below (Figure 6.24), the participant A talked about dripping problem in samovar type tea makers. The participant said that there were water drops dripping from the tab of the water tank , when she/he poured water into the tea glass from the samovar. Team

A designed a water collector like a saucer at the bottom of the water tank collecting dripping water. For the Matrix exercise, they developed this idea further and leave a space for the tea glass on the water tank.

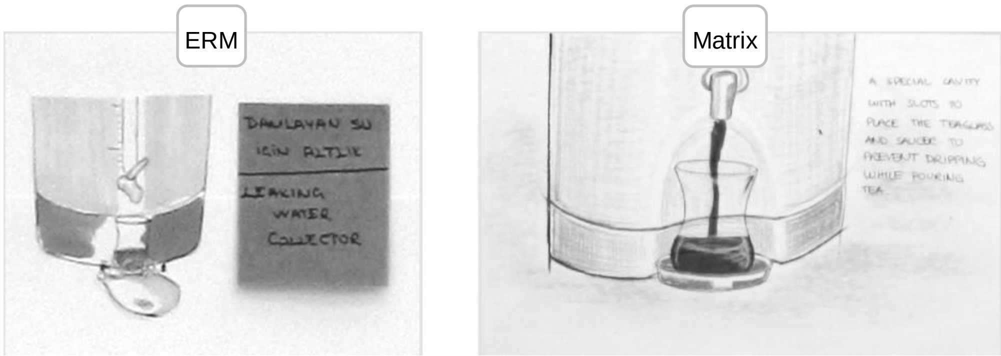


Figure 6. 24 An example of the inspiration process of Team A from the ERM analysis in the idea generation

As Team A thought that they didn’t sufficiently concentrate on the analysis phase and didn’t generate as much ideas as they could do, they turned back to the participant’s quotations during the Matrix exercise and reviewed other groups’ ideas to get inspired. Time limitation for the analysis phase was one of the drawbacks mentioned in the interviews. Time dedicated to the ERM analysis phase started at Tuesday afternoon and ended at Friday (in total 12 hours). The teams managed this time according to their plan. For some teams, a few hours left for sketching, as they spent more time for the preceding phases of the analysis. To this end, setting deadlines for the first part of the analysis and extending the time dedicated to the second part of the ERM analysis might be critical for the idea generation phase.

Team B thought that the second part of the ERM analysis was a warm up session for the idea generation, and first ideas for the Matrix were the ones that they developed for the ERM analysis. They mentioned that they sometimes started to develop an idea from the ERM, and then they came up with a different idea.

In the example below (Figure 6.25) the participant pointed out dripping problem during serving. Team B developed “non-dripping tea pot bottom” design solution area which allowed tea drops at the bottom of tea pot to fall into water tank. During the Matrix exercise, they continued with this idea and developed it for “drip minister” and “charismatic” theme - dimension combination.

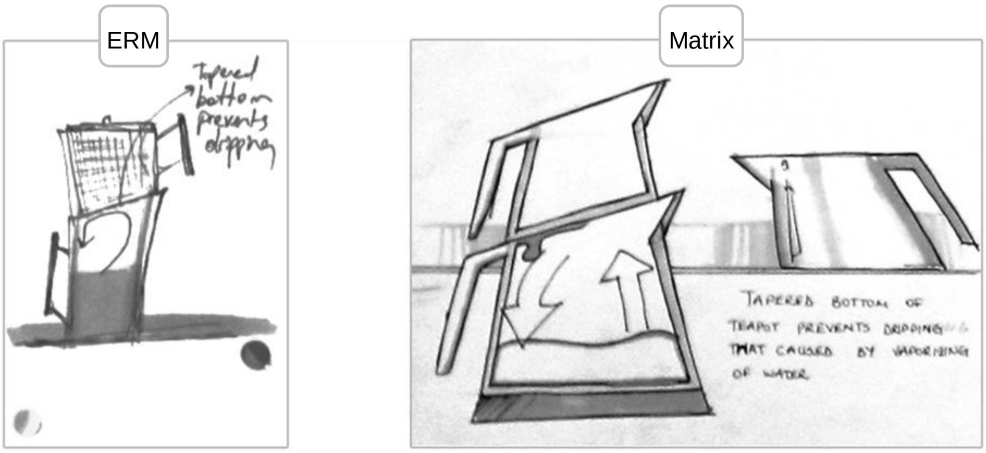


Figure 6.25 An example of the inspiration process of Team B from the ERM to the Matrix

Team B also claimed that they were only influenced by their participant, since there weren't an exchange of ideas among other teams. For example, their participant didn't talk about personalization in the session, hence they developed ideas for the personalized dimension independent from the ERM.

Team C reviewed their and others' ERM posters before starting the Matrix exercise. They stated that this Matrix exercise was much easier than the previous ones included in other educational projects, because they were inspired from the ERM analysis to a greater extent, since the ERM phases conveyed Team C to idea generation step by step.

The participant of Team C repeated a wish of a single piece tea maker during the ERM session. As a result, Team C influenced by that, and developed several ideas that brought tea pot and water tank in a single body. There are two different ideas such as "single piece tea maker" and "one handle" in the ERM poster (Figure 6.26). The team compiled those ideas into one during the Matrix under "drip minister" and "adjustable" combination. In this example, user can adjust tea density and pour tea at once.

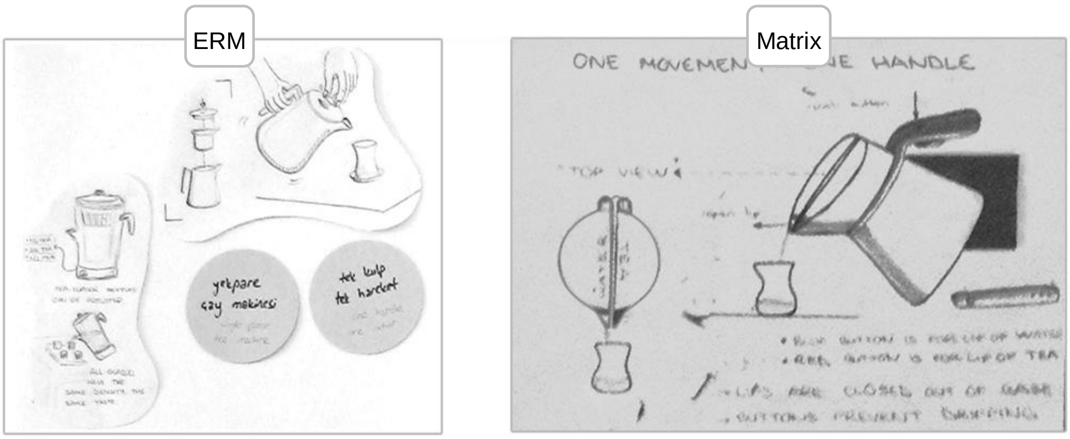


Figure 6.26 An example of the inspiration process of Team C from the ERM to the Matrix

The participant of Team D was an office user, hence this team developed more ideas for office use rather than other teams. They also tried to integrate the outcomes of the ERM about office into domestic environment. The example below presents one of the ideas which contextualizes a tea maker and serving set as a tea station at offices. During the ERM analysis, “tea station at office” design solution area was only represented by a base carrying a tea maker and its serving set. However, the team developed this idea and came up with two different potential product solutions for the Matrix (Figure 6.27).

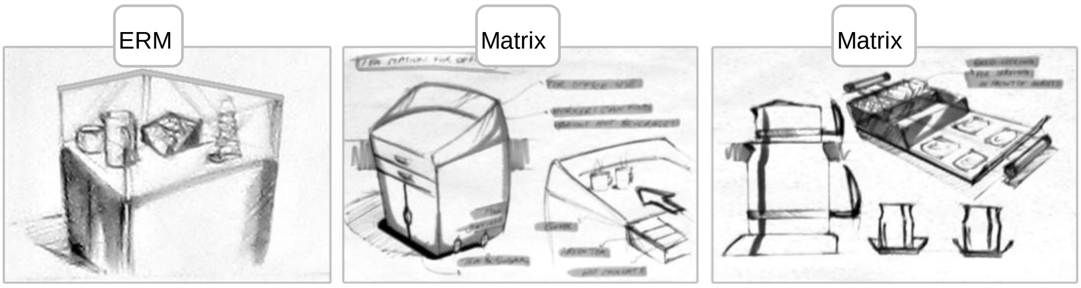


Figure 6.27 An example of the inspiration process of Team D from the ERM to the Matrix

Before starting the Matrix, Team E reviewed all ERM posters on the boards at the studio and developed the appropriate ones for the Matrix cells. However, they mentioned that they liked an idea at the ERM and wanted to develop it further, however there was not any relevant cell for that idea, then they gave up. As saucer was referring to drip, they developed the idea below although it wasn’t directly related with “drip minister” theme. In this idea, the saucer transforms into a snack plate if necessary (Figure 6.28).

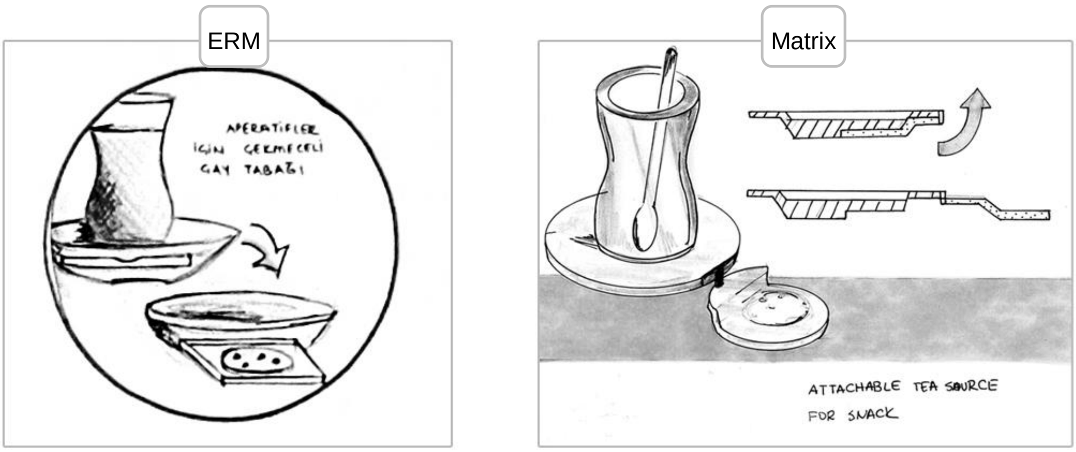


Figure 6.28 An example of the inspiration process of Team E from the ERM to the Matrix

One of the members of Team E stated that formats of the ERM analysis poster and the Matrix exercise were different from each other, and there were themes different from the ERM analysis, so they couldn’t transfer each idea into the Matrix exercise.

Although Team F was divided into two during the ERM, they prepared the Matrix poster together. As the interviews were conducted separately, Team F1 and Team F2 will be presented separately. Team F1 stated that they didn’t utilize the ERM in the Matrix to a greater extent, since their ideas at the ERM analysis were at the very initial level. As this team was also concerned about the time provided for the second part of the ERM analysis, they might not have time to elaborate on the ideas during the ERM sketching phase. They also mentioned that they couldn't benefit from the ERM for the dimension "charismatic" in the Matrix, because their participant didn't talk about aesthetic appearance of a tea maker and serving set at the ERM session. The example below was one of the few examples that they explicitly mentioned. Team F1 developed "never spills water" design solution through closing the spouts of the tea pot and the water tank (Figure 6.29). The development of the idea for the Matrix was mainly on the form of the tea maker.

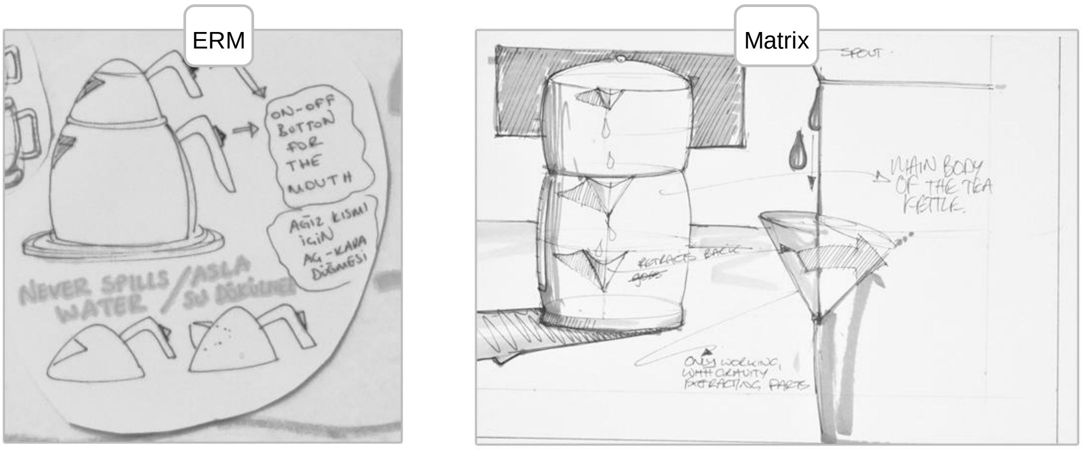


Figure 6.29 An example of the inspiration process of Team D from the ERM to the Matrix

In Team F2, one of the students admitted that she/he didn't participate in the Matrix exercise. The team mentioned that they benefitted from the ERM subconsciously, and except one example they couldn't remember anything specific to the ERM analysis.

In the example below (Figure 6.30), the size of the tea maker changes according to the needs of the user. In the Matrix exercise, they related it with "resource activist" and "adjustable". The tea maker scales down, by this way less energy is used for boiling.

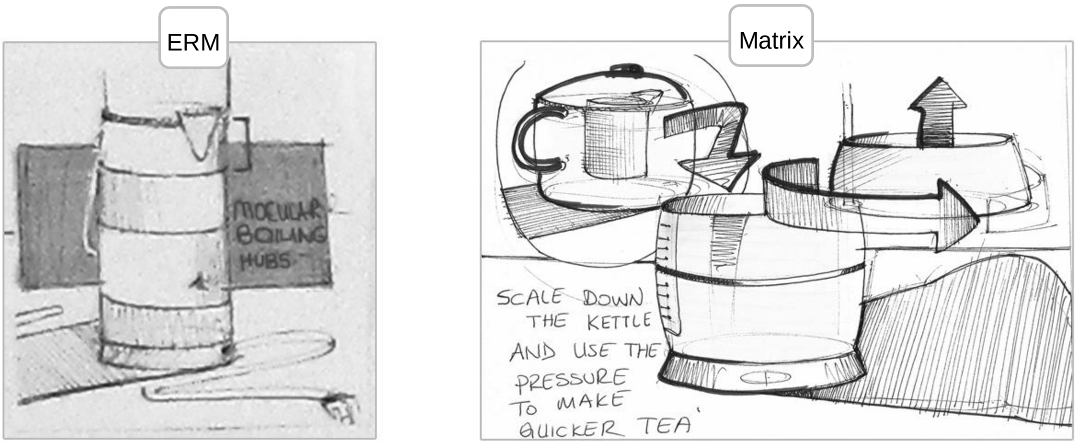


Figure 6.30 An example of the inspiration process of Team D from the ERM to the Matrix

Not only the ERM analysis phase but also the session led the students during idea generation. Most of the teams mentioned that they started to generate ideas during the ERM session, and they recalled what the participant said while completing the Matrix exercise (Tables 6.2 & 6.4). This is the iterative nature of design process that it doesn't follow a linear path. The 3D modelling phase in the sessions enabled the students to realize design solutions simultaneously. On the other hand, some of the student couldn't give specific examples when they were asked to what extent they benefitted from the ERM analysis. After they were shown their posters, they realized that they benefitted from the ERM subconsciously to a greater extent during the Matrix. Most of the students were influenced by the ERM results during the idea generation phase. The level of influence was based on:

- Transfer of the idea through slight changes on the form (Figures 6.24, 6.25, 6.29)
- Adding new features to the potential design solution (Figure 6.23)
- Compiling diverse ideas into one product design solution (Figure 6.26)
- Development of the concept into a product idea (Figure 6.27)
- Detailing the potential design solution (Figures 6.28, 6.30)

6.6 The ERM for Future Adaptations

In this field study, intentions of the students to use the ERM in future projects were asked during the interviews. The aim of this part was to mainly understand the potentials for and the drawbacks of the ERM. Since the tools and techniques used in the ERM (i.e. interview schedule, toolkit, sample analysis formats, etc.) and the phases were developed by the researcher and the studio tutors, the students replied the questions related to the phases of the ERM without thinking the development phase of the ERM. However, they had to think about the adaptation and the development of it when they were asked about the usage of the ERM in the future. By this way, they started to uncover the potentials for and limitations of the method (Table 6.5).

The ERM can be adapted to different design projects through implementing particular knowledge and skills gained at the ERM phases into different research methods. For example, knowledge and skills gained from interviewing and analysis phases of the ERM can be incorporated into any other researches conducted in future projects. The students believed that they could adapt the question types in the interview schedule, and use them in a more flexible session. They weren't sure that they could develop a toolkit for any types of product, since it required an expertise. Hence, they suggested many mediums that could substitute the toolkit such as drawing, using existing products, and using small mock-ups for large scale products. ERM toolkit consists of abstraction of a product which is the subject of the research; however it is critical to explain this abstraction level, materials and parts used in the toolkit.

Table 6.5 *The teams' motivations and drawbacks to use the ERM in the future*

		A	B	C	D	E	F1	F2
motivations	Interviewing phase of the ERM can be adapted into future projects using the questions types in the interview schedule		■	■	■		■	
	The analysis phase of the ERM especially sketching in line with the design solution areas can be adapted to any kind of user research		■	■			■	
	The ERM session can be conducted more flexible by using drawing technique or existing products as well as a simple toolkit in a more informal environment			■			■	■
	The ERM can be used to explore user-product interaction in particular product categories which have interfaces such as small kitchen appliances				■	■	■	
	The ERM session can be conducted during the evaluation of a product					■		
drawbacks	Since the preparation phase of the ERM is difficult, it can be conducted only as a team	■	■	■				
	It is difficult to develop toolkit for every single product type	■	■	■	■			■
	The ERM can be conducted with more than one participant, since only one participant limits to see the diversity in users		■	■				
	The ERM is more applicable for educational cases rather than companies, since companies may not offer facilities for the ERM	■			■	■		

The students associate the ERM with exploring user product interaction, since it focuses on particular interactions through bringing together the components of a product by using the toolkit. Hence, they believed that it could be used for the product categories with interfaces. They mentioned that it could also be used to evaluate a product by using a prototype in further phases of a product design and development phase.

Workload was one of the concerns for the teams since the ERM required many phases. However, working as a team would ease the process and enabled the students to gain different points of view at the analysis phase. They were also aware that conducting the ERM individually would need some simplifications in the method.

Another limitation of the ERM for the students was conducting the ERM sessions with only one participant. Conducting the ERM with more than one participant would need more time but would enable them to understand diverse user profiles.

As this case was an educational case, each phase of the ERM was planned by the studio tutors. For future projects, the students will be responsible to make their time management. The students wouldn't believe that companies in Turkey could provide so much time and facilities for short term project. However, it's up to designers whether they can flex the process and time period allocated for each phase if they know how to adapt the ERM method.

6.7 Discussion of the Qualitative Part of the Field Study

In the previous sections, motivations and difficulties related to the ERM phases, implementation of the ERM in idea generation, and potentials and limitations to adapt the ERM for another project were explained based on the industrial design students' perspective.

Diagrammatic representations as a means of sharing information and emerging themes are used to externalize and communicate interpretations and evaluations (Gray & Malins, 2004). Moreover, visualizing the emerging themes based on the findings appeared to be helpful to understand their interrelations affecting student engagement in the ERM process, and encourage discussion for further development of the ERM method.

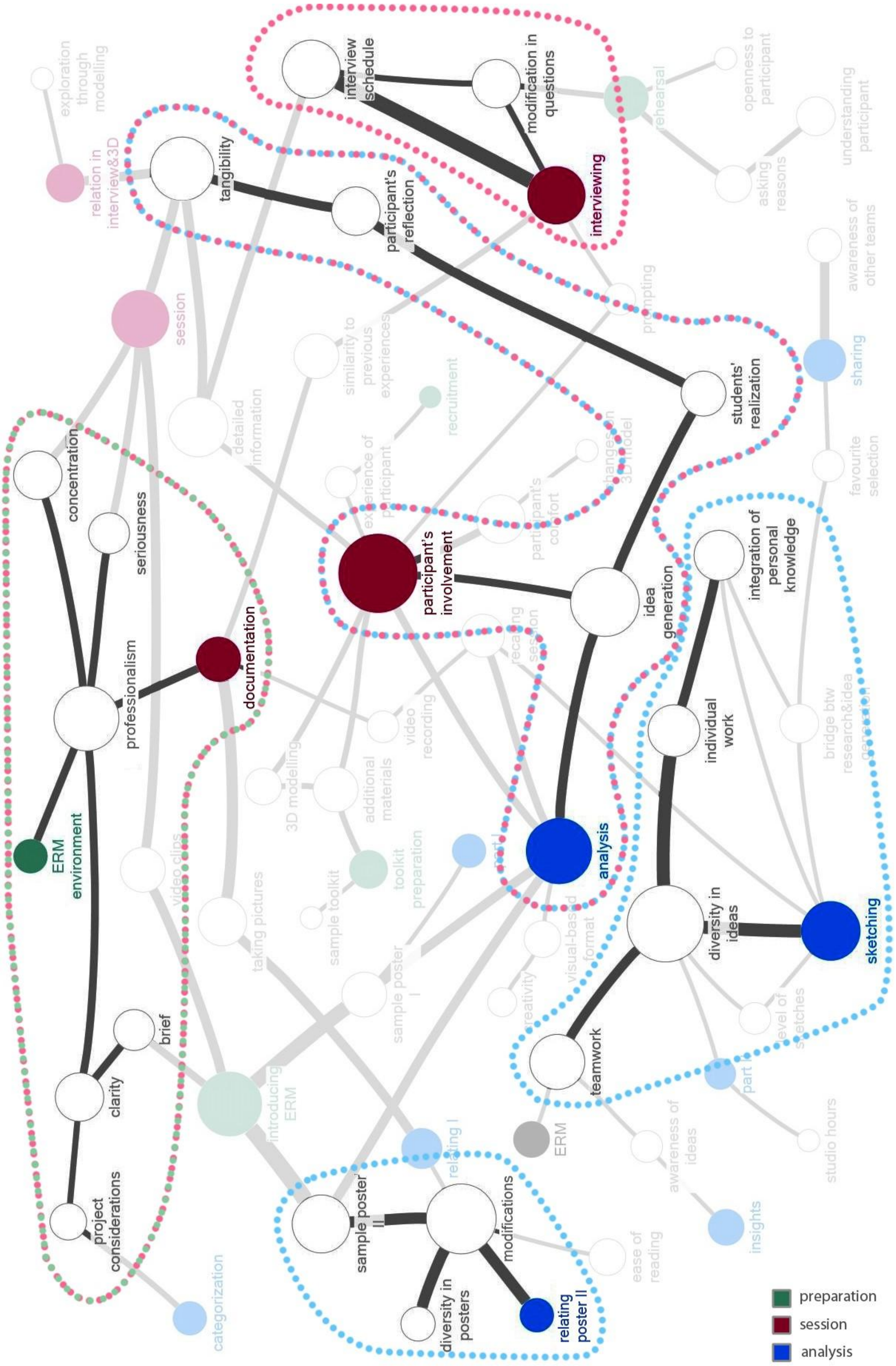


Figure 6.31 Motivations affecting student engagement in the ERM

Diversity in ideas as the outcome of the ERM seems to be the most outstanding motivation for the industrial design students. Whether the students work as an individual or a team, diversity is mainly related to the analysis phase of the ERM. While *teamwork* supports awareness of other team members opinions and ideas, *individual work* encourages integration of personal knowledge into participant's one. Both provide divergence of ideas during the analysis phase (Figure 6.31). However, the level of i*nfluence by the participants* during the analysis phase stands on the borderline which has the potential to reduce the student engagement in the ERM analysis (Figure 3.32). The ERM shouldn't be perceived as designing with people, otherwise the students would remain loyal to the participants' solutions mentioned during the sessions in the analysis phase. Yet the ERM analysis aims to merge people's knowledge with students' one. Even by this way, the students can develop innovate and creative ideas as diverse as possible.

Modifications on the provided materials such as sample posters, toolkit and interview schedule made the ERM more engaging process for the students. They adapted the sample posters to make them readable and different through reflecting their creative skills on the analysis phases. They also added materials to the provided toolkit to enrich the 3D modelling experience in the sessions. Modifications in the interview schedule by changing the order of questions, and adding prompts and new questions helped the students understand and guide the participants.

Feeling like a professional motivates students and attributes the sense of being a designer or researcher to them (Reid & Solomonides, 2007). *Clarity* in the ERM phases, arrangement of a specific environment for the sessions and documentation of the session in detail increased the sense of feeling like a professional. *Professionalism* supported both students' and participants' concentration and seriousness in the ERM sessions. Although the phases of the ERM were clear enough, the definition of insights and design solution areas weren't stated in the ERM brief. Additionally, categorising design solution areas that were developed without considering the project design considerations became difficult because of the irrelevant DSAs with the design ideas (Figure 6.32).

The participants have chance to explore their experiences, needs and expectation through reflecting on the 3D models in the sessions. However, *participants' reflection* on the 3D models is closely related to the materials and parts in the toolkit. *Diversity in the toolkit* should be provided to enrich the involvement of participants in the modelling process (Figure 3.32). Tangible 3D models as the outcome of the ERM sessions helped the students realize what the participants talked about, since 3D modelling process was also one of the design skills of the students at idea generation phase. *Tangibility* in the sessions enabled the students to gain more information from the participants, and conveyed them to the *idea generation* phase easily (Figure 3.31).

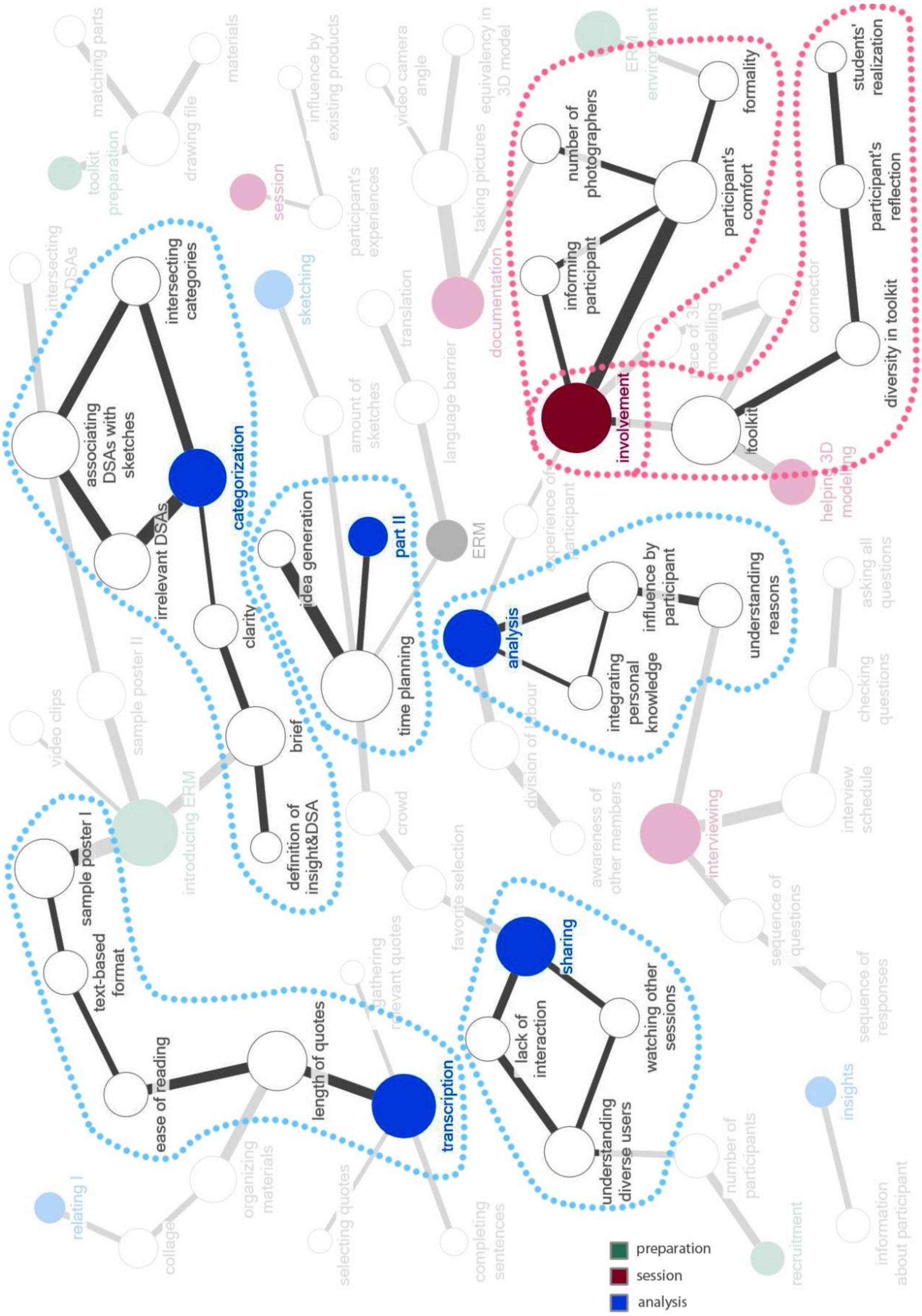


Figure 6.32 Difficulties affecting student engagement in the ERM

Sharing outcomes of the ERM is essential to understand diverse user profiles and diverse approaches of the students towards the ERM analysis. However, there was a *lack of interaction* among the teams, since each team focused on their ERM process until the sharing phase (Figure 6.32). For an expressive and responsive interaction, analysis posters should provide effective sharing of knowledge retrieved from the ERM. For example first analysis posters didn't provide ease of following and reading because of its highly text-based format (Figure 6.32). Exploring the potential of encouraging interaction among teams at different ERM phases becomes prominent in terms of developing the method further.

Time planning is one of the most mentioned difficulties in the ERM. At some phases of the ERM such as preparation of the toolkit, the students thought that allocated time was too much which limited the time for the idea generation phases of the project. On the other hand, allocated time for the second part of the analysis and sharing weren't enough for the students regarding the overall workload required for the assignments. It appears to be challenging for the researcher to balance the time schedule for each phases of the ERM.

Participants' comfort enriches active involvement of the participants in the ERM sessions. It is related with various factors such as ERM environment, documentation, informing the participants about the study, and so on. Making the participants feel more comfortable in the sessions is vital to gather detailed information from them for the analysis phase (Figure 6.32).

The suggestions and conclusions for developing and integrating the ERM into industrial design education at undergraduate level should

- provide clarity and relevance for each phase of the ERM (i.e. presentation, brief, drawing file for toolkit, etc.);
- balance allocated time considering workload for each phase of the ERM;
- enhance professionalism and collaboration in the ERM;
- enrich active involvement of the participant in the sessions;
- enable the students to integrate personal knowledge and skills into various phases of the ERM;
- support effective sharing through interaction among the students;
- encourage the students to use the outcomes of the ERM at idea generation phases.

6.8 The Questionnaire for the Assessment of the Findings

Based on the findings of the qualitative analysis of this field study, a questionnaire was developed to evaluate the findings. A pilot study was conducted with a design student recruited from the first implementation of the ERM. After the pilot study, some wordings were modified to clarify the sentences. The questionnaire was handed out to the students who were the subject of the main field study. Since this stage was developed after the analysis of the qualitative part, it was held at 15th of February 2013 when the students enrolled in the fourth year of industrial design program. Twenty two students filled out the questionnaire at the studio, and ten students were reached via e-mail.

The questionnaire was composed of two parts (Appendix N). In the first part, brief information about the ERM phases with corresponding images was provided to remind the students the process, since one academic term passed after the students conducted the ERM.

In the second part, the students were asked to specify their level of agreement on 61 items on a five point Likert Scale. Individual items in Likert Scale had five-response alternatives as “strongly disagree”, “disagree”, ‘neutral”, “agree”, and “strongly agree” to find out to what extent the students agreed the findings of the research. However, it is worth considering that this questionnaire mainly aims to support the interpretation of the findings of the qualitative research rather than verification of them. The results of the qualitative and quantitative parts may not support each other to a greater extent because of the limitations of the Likert scale. The students might hesitate to check extreme responses such as strongly agree or disagree; or they might be agreed with the items to please the researcher (Bertram, 2007; Robson, 2002).

To test the internal reliability of the questionnaire, Cronbach’s alpha coefficient was calculated; it was found as .82 for the whole scale (Appendix O). Then, descriptive statistics (i.e. mean, standard deviation) and central tendencies (i.e. mean, median, and mode) of each item were analysed separately by using software SPSS Statistics 20 (Appendix P). The items were grouped under the identified themes to facilitate the discussion for the results such as:

- Clarity and relevance
- Workload and allocated time
- Professionalism and collaboration
- Active involvement of the participant
- Integration of personal skills and knowledge
- Effective sharing
- Comprehension and idea generation

It was not aimed to measure the themes or to verify relationships between these themes with this categorization, each item were interpreted individually. It was only aimed to ease the reading through compiling the findings of similar items.

The reason to mainly use central tendency (summarized by median and mode) for the presentation and interpretation of the data was that the participants were asked to select their agreement level through an ordinal scale in which intervals between values couldn’t be assessed equal. As Kuzon et al. (1996) argued, the average of “agree” and “strongly agree” is not “agree and a half”; even when numbers (i.e. 1 – 5) are assigned to represent agreement levels. The central tendency graph of all items in the questionnaire is presented in Appendix Q.

As a result of the qualitative part of this field research, clarity in the ERM phases should be provided, and each phase should be interrelated with each other. The presentation explaining the ERM and its phases with the video clips from the pilot ERM session clarified the ERM phases and the ERM session (Q1, Mode = 4, M = 4.34, SD = .65; Q4, Mode = 5, M = 4.59, SD = .80). Moreover, the ERM brief including first and second analysis sample posters were clear enough to demonstrate the analysis phase (Q2, Mode = 4, M = 4.25, SD = .76; Q26, Mode = 4, M = 4.03, SD = .82; Q27, Mode = 4, M = 4.00, SD = .80). Additionally, how to transcribe the participants’ statements (Mode = 4, M = 3.63, SD = .83) and how to sketch in response to the design solution areas (Mode = 4, M = 3.81, SD = .69) were also understandable for the students (Figure 6.33).

Another supporting result of the questionnaire was that the students couldn’t reach an agreement on the clarity of the project considerations (Q30, Mode = 3, M = 3.56, SD = .91).

As previously mentioned, contents of the design considerations were too broad that they were intersecting with each other at some points. Then, it was not easy to relate the design solution areas with the categories (Figure 6.33).

Locating the design solution areas and sketches on the second posters related to more than one design consideration was difficult as the students mentioned during the interviews and the questionnaire. Beside the contents of the considerations, this difficulty might be resulted from the irrelevancy of the design solutions areas with the project considerations, as they didn't develop their DSAs based on the project considerations. Yet, most of the students thought that their DSAs were related with given considerations according to the questionnaire (Mode = 4, M = 3.56, SD = .95) (Figure 6.33).

On the other hand, the students mentioned several times in the interviews that they didn't entirely understand how to gain insights and how to develop design solution areas based on their insights as those weren't clearly defined in the ERM brief. However, the results of the questionnaire show that most of the students agree on the clarity in gaining insights and developing design solution areas (Q28, Mode = 4, M = 3.66, SD = .87; Q29, Mode = 4, M = 3.66, SD = .70) (Figure 6.33).

Another contradiction between the interviews and the questionnaire was about the rehearsal and the ERM sessions. They didn't rehearse the sessions in a particular format as the studio tutors let the students free in the rehearsal phase. Some of the teams rehearsed by only reading the questions, or without using the toolkit. That resulted in lack of collaboration in terms of assigned task (e.g. documentation, helping 3D modelling, etc.) in the ERM sessions of some teams. The finding revealed inconsistency in the rehearsal technique that the teams used. However, many of the students agreed that rehearsal was clear enough in the ERM (Mode = 4, M = 4.09, SD = .82). The students also mentioned that it was difficult to check and ask all of the questions in the interview schedule as the sequence of the questions might vary according to the participants' responses. Some of the teams noticed this difficulty during the rehearsal, and took some precautions to check the questions such as note taking, assigning a student for checking the questions or grouping the questions according to the topics. The results of the questionnaire surprisingly supported that the interview schedule enabled most of the students to check the questions easily (Mode = 4, M = 3.97, SD = .97) (Figure 6.33).

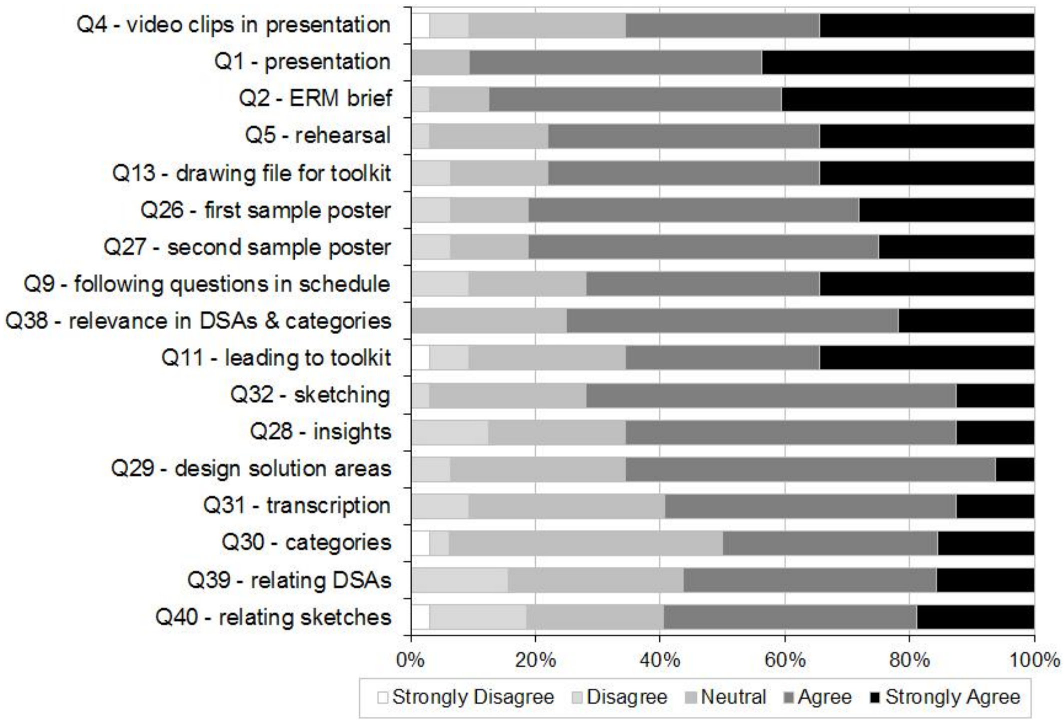


Figure 6.33 Percentiles of responses about clarity and relevance

Some of the students concerned about the total time dedicated for the ERM as they needed more time for the further phases of the project. Especially for the preparation phases of the ERM such as rehearsal and toolkit preparation, they mentioned in the interviews that the allocated time was too much considering the workload. On the other hand, they were sure that the time for the second part of the analysis and the sharing phase should be much more than the provided (Q59, Mode = 5, M = 3.94, SD = 1.01; Q61, Mode = 5, M = 4.03, SD = .97). On the other hand, most of the students agreed that the collage technique was adequate for the preparation of the first posters even though most of the teams prepared digital environment for the preparation of their first posters (Mode = 4, M =3.91, SD = 1.03). They mentioned during the interviews that collage technique was time consuming and exhausting for organizing materials (Figure 6.34).

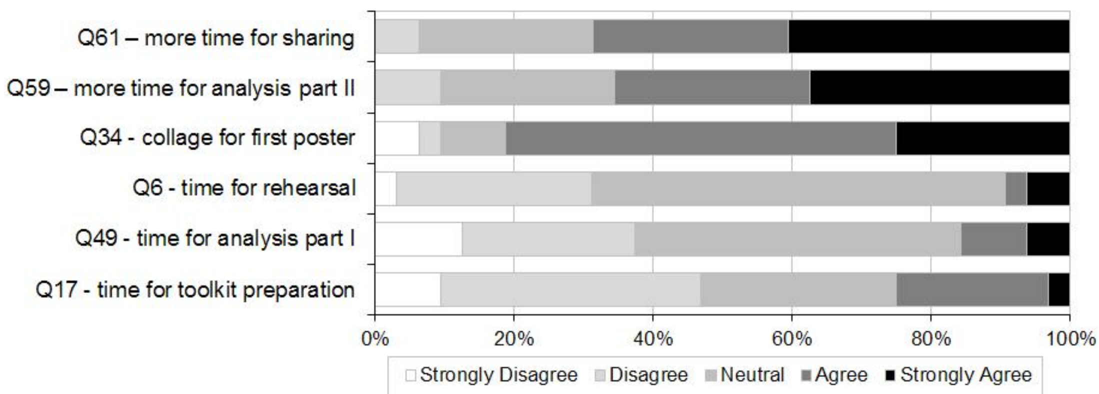


Figure 6.34 Percentiles of responses about workload and allocated time

According to the results of the qualitative part, professionalism in the ERM supported both students' and participants' concentration and seriousness in the sessions. Arranging a specific environment for the sessions and documenting the session had an effect on the student's feeling like a professional researcher. The results of the questionnaire also supported this insight (Q21, Mode = 4, M = 4.06, SD = .98; Q23, Mode = 4, M = 3.69, SD = 1.18; Q25, Mode = 4, M = 3.78, SD = 1.04). However, the students mentioned that taking pictures and recording the session became difficult, because the location of the toolkit hindered visibility of the modelling area on the table. The results of the questionnaire contradicted with the results of the qualitative part of the research (Figure 6.35).

As mentioned before rehearsal helped the students work collaboratively during the ERM sessions. However, some of the teams had difficulty in this collaboration, since division of labour wasn't clear in some teams. However, the students believed that division of labour was clear in the ERM based on the findings from the questionnaire (Mode = 4, M = 4.00, SD = .84). On the other hand, effective help for the participant in the 3D modelling process is another aspect of successful collaboration among the teams. The students pointed out that they understood how to use the toolkit during the preparation of it. This seemed to be supported by the quantitative part of the research (Mode = 4, M = 4.19, SD = .64) (Figure 6.35).

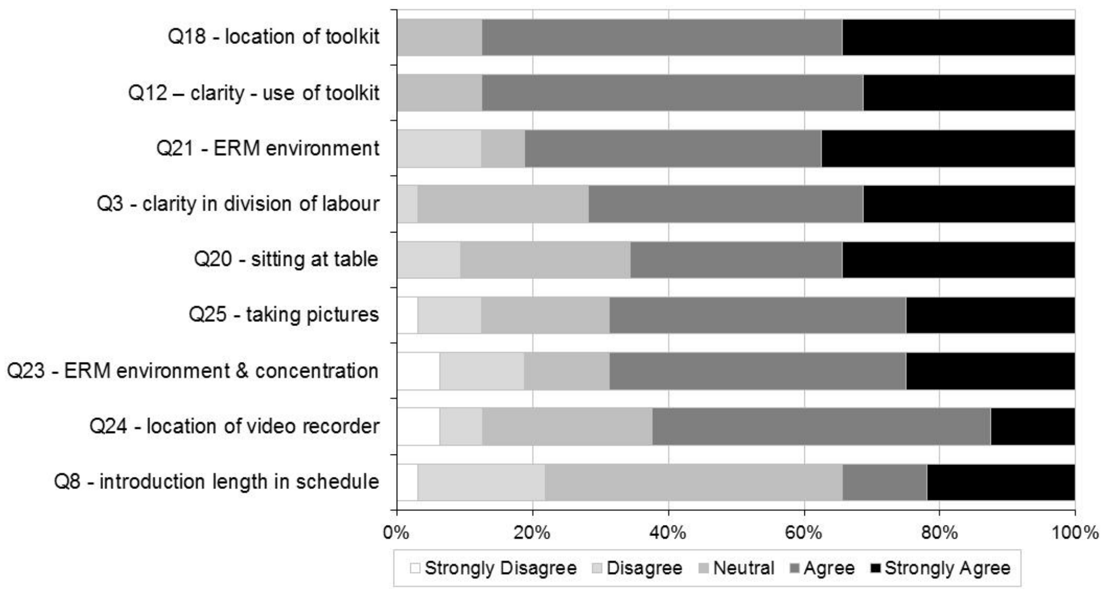


Figure 6.35 Percentiles of responses about professionalism and collaboration

Active involvement of the participant in the ERM session depends on various factors such as diversity and simplicity in the ERM toolkit, arranging specific environment for the sessions and informing the participants about the study in advance. The results except diversity in the toolkit supported the importance of those (Q19, Mode = 4, M = 4.00, SD = .88; Q22, Mode = 4, M = 3.94, SD = .95; Q55, Mode = 4, M = 4.31, SD = .59). Although the students wished the toolkit would have included different shapes, volumes and additional materials, most of them agreed that the parts and materials in the ERM toolkit were adequate for the participants to reflect their responses on the 3D model (Mode = 4, M = 3.50, SD = 1.14).

Another concern about the toolkit was efficiency of the connector material (i.e. Tack-it) (Mode = 3, M = 3.41, SD = 1.16), since it wasn't efficient to connect play dough with other parts (Figure 6.36).

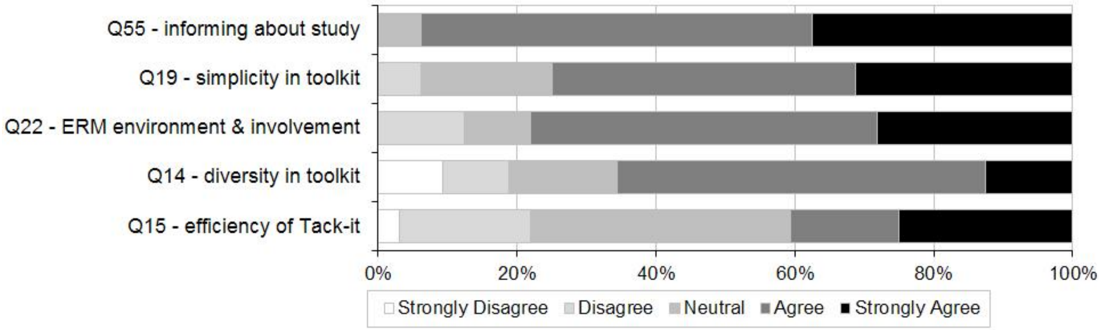


Figure 6.36 Percentiles of responses about issues affecting involvement of the participants

Opportunity to integrate personal skills and knowledge into the various phases of the ERM motivated the students. This integration showed differences according to the phases. For instance, they could add different questions to the interview schedule and add different materials to the toolkit more than provided during the early stages of the ERM. During the analysis of the ERM, they tailored the second sample poster according to their needs and preferences. They also integrated their knowledge and experiences into the participants' one during the ERM analysis. One of the aspects that they weren't sure of was that level of influence by the participants during the second part of the ERM analysis. All of those findings from the qualitative part were supported by the questionnaire findings (Figure 6.37). On the other hand, almost all of the teams prepared their first posters similar to the sample one. Although, the students mentioned that first sample poster for the analysis didn't enable them to make changes on it, they seemed to agree that the sample poster for the first phase of the analysis enabled them to create their unique posters (Mode = 4, M = 3.88, SD = .79) (Figure 6.37).

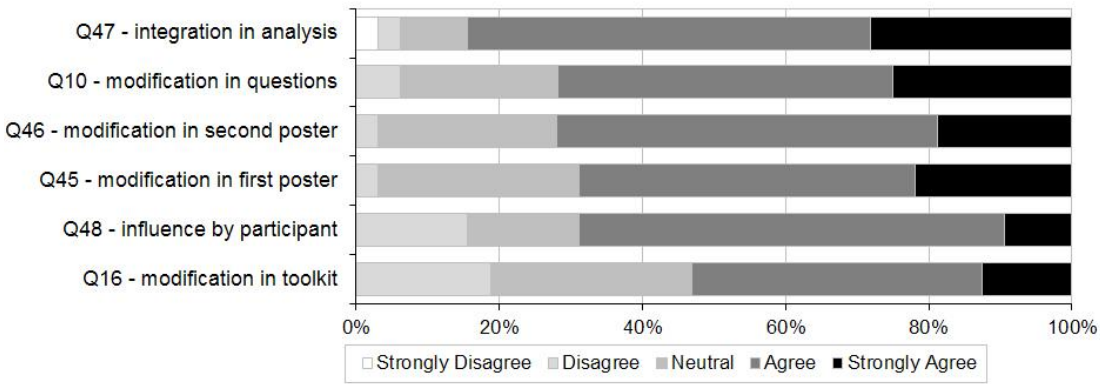


Figure 6.37 Percentiles of responses about the students' integration of their skills and knowledge into the ERM

Supporting effective sharing through interaction among the students is important to help them understand diverse user profiles for the idea generation phases. The presentation posters for the analysis were effective way of sharing, but they believed the length of quotes reduced the readability of the first posters. Hence, they preferred to overview the design solution areas and sketches of other teams, since they were more easy to read and follow. Although the students benefitted from the analysis posters of other teams during the ERM, they wished to see other teams' ERM sessions, to exchange ideas with other teams during the ERM analysis, and to present their posters to the studio in order to enrich the sharing phase (Q54, Mode = 5, M = 4.53, SD = .67; Q58, Mode = 4, M = 4.31, SD = .64; Q60, Mode = 4, M = 4.00, SD = 1.05) (Figure 6.38).

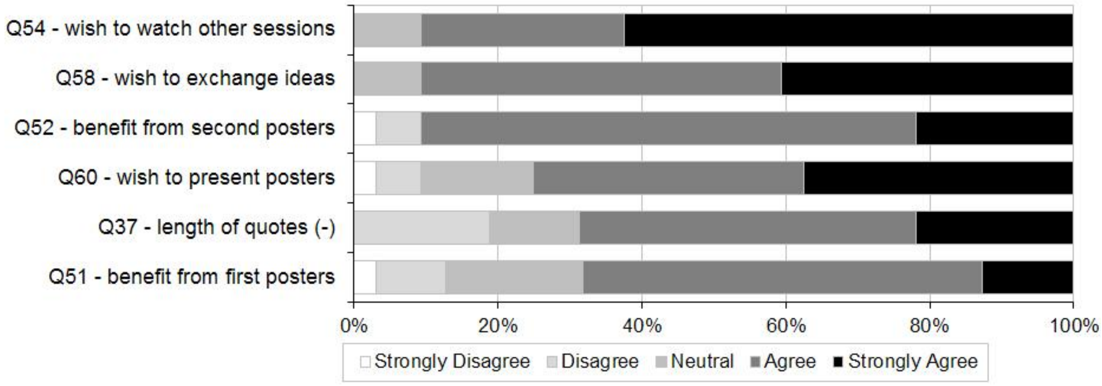


Figure 6.38 Percentiles of responses about sharing related items

Implementation of the outcomes of the ERM in the idea generation phases starts with understanding the participants' experiences, needs, expectations and preferences thoroughly. After comprehending those, the analysis phase becomes easier in terms of gaining insight and developing design solution areas. During the ERM sessions, questions in the interview schedule helped the students understand the participant's experiences with the tea making and tea serving. The session remained in the students mind, and they recalled the session during the analysis phase as well as applying this to the insights and DSAs. Transcriptions of the participants' statements seemed the least applied source for idea generation since they were longer than insights and DSAs (Figure 6.39).

Finally, the students wished to have technical knowledge before the ERM, since lack of technical knowledge made difficult for developing technical details for the sketching phase (Mode = 4, M = 4.09, SD = .86). Additionally, most of the students wished to have more information about the participants' existing products, since understanding the participants' experience with the existing products supported the comprehension of the participants' reasons for their needs and references during the ERM sessions (Mode = 4, M = 3.66, SD = .90) (Figure 6.39).

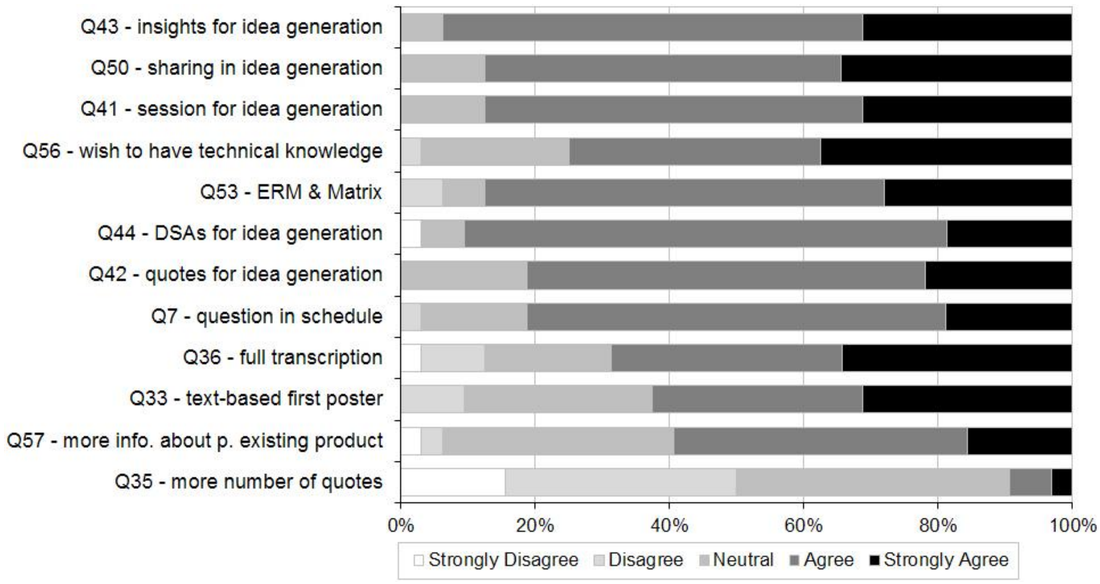


Figure 6.39 Percentiles of responses about understanding participants and usage of the outcomes in the idea generation phases

As discussed above, most of the items were agreed by the students. The students appeared be more positive considering the quantitative data. The contradicting items might be resulted from this limitation of the Likert scale and time period between the qualitative and quantitative parts of the research. This questionnaire helped the researcher interpret the identified issues and problems retrieved from the qualitative results and to draw conclusions for the development of the ERM further.

6.9 Conclusion with Further Research on the ERM

This field study included the development of the ERM according to the findings of the previous research (Chapter 5), the implementation of the ERM in another education case at the third year industrial design studio, the observations and the interviews with the industrial design students to explore the motivations and difficulties in the ERM, and the questionnaire to evaluate and support the findings of the qualitative part of the research. The ERM was improved further based on the finding of this field study, and incorporated into another educational case (i.e. "Engaging and Sustainable Design Solutions for Tea Making and Serving Experience") in 2013, spring semester.

For the clarity of the ERM, the ERM brief was developed in terms of explaining the definitions of insights and design solution areas in the analysis phase. The presentation explaining the method included clues about teamwork in the sessions to enhance the collaboration among student team members. Additionally, the drawing file for the preparation the toolkit was improved further so that it enabled the students to prepare their toolkit easily. For an effective use of the toolkit, some parts were added to the ERM toolkit.

For the next case, allocated time for the phases of the ERM was also changed considering workload. Especially, a particular time period for a structured rehearsal was arranged for the teams so that they could get familiar with the interview schedule, toolkit and division of labour in the sessions. The number of students was reduced to four or five based on the assigned tasks in the sessions. Besides, submission for the ERM analysis was divided into phases in order to balance the time dedicated to each phase.

To enable the students to follow and ask the questions more easily, format of the interview schedule was changed. Various usage scenarios were added into the content of the interview schedule to encourage the participants to respond to the questions based on a particular scenario and context. The participants were informed in advance by providing an informative text about the ERM and the research to prime them for the sessions. Hence, they warmed up, and were more actively involved in the sessions.

For an effective sharing to understand diverse user profiles for idea generation, first part of the analysis was changed. The most fundamental change was the presentation technique used in the first part. Video presentation was offered to support interactive sharing of the outcomes of the sessions. By this way, the students were able to see other teams' sessions. Second part of the analysis was also presented by the student teams beside the first part.

Better associations between the design solution areas and sketches in the second sample poster were provided to guide the students how to connect those visually. The students were encouraged to develop their design solution areas under the design considerations to better relate the solutions with the project considerations. Moreover, the size of the second posters was extended to provide more space for sketching and idea generation.

CHAPTER 7

PRIMARY CASE III: TEA MAKING AND SERVING EXPERIENCE

In this chapter, changes on the ERM method that has been incorporated into an educational project will be explained in detail with the findings and conclusions of the field study aiming to gain further feedback about those changes from the design students.

Within the context of the doctoral study, the ERM was lastly incorporated into a design education project (i.e. “Engaging and Sustainable Design Solutions for Tea Making and Serving Experience”) in 2013, spring semester. Interviews with the student teams and a questionnaire with the design students were conducted to gain feedback about the major changes of the ERM (Figure 7.1). Throughout the ERM process, the researcher made observations and took notes to assess the process.

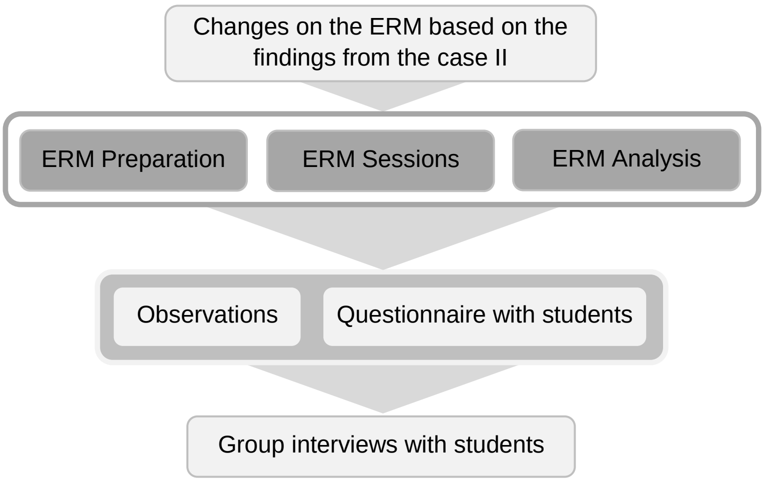


Figure 7.1 Structure of the final field study

The design project aimed to reframe making and serving tea as an enriching experience, and to develop engaging design solutions which reinforced local values, encourage maintenance and repair, and raised awareness about consumption of resources (Appendix R).

Based on the findings from the main field study presented in the Chapter 6, particular changes were made on the ERM method (Appendix S) that were incorporated into this educational project such as:

- Providing technical information for design details of a tea maker before the ERM
- Integrating video clips into the ERM presentation to represent teamwork
- Arranging a particular time for rehearsals
- Limiting the number of students to four or five in the teams
- Adding new parts to the ERM toolkit
- Improving the drawing file for the toolkit

- Changing the format and the content of the interview schedule
- Informing the participants about the ERM and the research in advance
- Incorporating the definition of insights and design solution areas into the brief
- Enabling the students to develop design solution areas under the project considerations
- Changes on the first part of the ERM analysis
- Changes on the sample poster II
- Providing short presentations of the analysis posters

To assess these changes, a questionnaire was developed similar to the questionnaire conducted at the previous field study. In this one, the items were slightly modified based on the suggested changes on the ERM method. There were 59 items. Some items related to presentation, first part of the analysis and presentation of the findings, sharing, and technical knowledge provided (i.e. items 55R, 26R, 33R, 36R, 42R, 51R, 50R, 56R, and 57R) were revised. New items were added about sharing and video presentations for the first part of the ERM analysis (i.e. items 62N, 63N, 64N, and 65N) (Appendix T). Some items in the previous questionnaire were excluded which were considered as irrelevant to this implementation of the ERM (i.e. items 31, 34, 37, 45, 54, and 60) (Appendix N).

Twenty eight students out of 29 filled out the questionnaire after the ERM ended in the design project. Items were analysed by using the same technique in the previous questionnaire (i.e. descriptive statics and reliability analysis) (Appendices U, V & W). Cronbach's alpha coefficient was calculated to test internal reliability, and it was found as .83 for the whole scale. After the analysis of the questionnaire, group interviews were conducted with six student teams about the major changes on the ERM method (Appendix X). The interviews lasted approximately 35 minutes per team.

7.1 Giving Technical Information about a Tea Maker before the ERM

In the previous educational case, the disassembly-assembly session about a tea maker was conducted after the ERM to give technical information about working principles of a tea maker. However, the students mentioned that they needed it before the ERM to develop the design solutions based on technical details. To this end, this session was conducted at an earlier stage, before the ERM in this project.

The results of the questionnaire showed that providing technical information about a tea maker before the ERM supported the students' idea generation phase to some extent (Mode = 4, M = 3.43, SD = 0.92). Some students thought that being informed by technical information before the ERM enabled them to develop more feasible design ideas during the second phase of the ERM analysis. However, the rest didn't find a relationship between the assembly-disassembly session and the ERM.

7.2 Informing the Participants about the ERM and the Research in Advance

In the previous case, some participants didn't know anything about the ERM session and hesitated to use the toolkit at the very beginning of the sessions. That affected their active involvement. Hence, giving information beforehand appeared to be important to enrich the involvement of the participants through priming them for the sessions. To this end, they were informed in advance by providing an invitation letter. The teams gave this letter to their participants. It included a consent form with brief information explaining the ERM, and the role of participants in the sessions. The level of information in this letter was critical, since it aimed to prime the participants for the sessions (Appendix Y).

The student teams stated that they gave information to the participants about the ERM sessions verbally beside the informative text. They thought that talking about the ERM was more effective than reading. The questionnaire results also revealed that informing the participants prior to the ERM sessions supported their active involvement (Mode = 4, M = 4.04, SD = 0.64).

7.3 Limiting the Number of Students at Four or Five in the Teams

There were five or six students in the teams in the previous case. There were two photographers in the teams of six members. They mentioned that one photographer was enough to take pictures and the crowd created by the students in the ERM environment might not be comfortable for the participants. Furthermore, the researcher observed that recording the session didn't require much work. The recorder was set before the sessions, and the student who was responsible for video recording didn't need to do anything else than checking whether it was working or not. In this case, the number of students in the teams was limited at four or five. It was recommended that one student was responsible for video recording, one for taking pictures of the model being built, one for asking the questions to the participant, and one for helping the participant for the 3D modelling process. Unlike the previous implementation of the ERM in the educational case, the students didn't mention the number of students in the sessions during the interviews.

7.4 Arranging a Particular Time for Rehearsals

A particular time slot for a structured rehearsal was arranged for the teams before the ERM sessions. The rehearsal program was scheduled and announced to the students. The rehearsals were conducted at UTEST with representative participants that the teams invited (Figure 7.2). In some teams, the participant was a member of the team. It aimed to help the students get familiar with the ERM environment, the interview schedule, the toolkit and the division of labour in the sessions. Each rehearsal lasted 30 minutes. In this period of time, the students were not able to ask all of the questions, but they were satisfied with the duration, since it helped them how to arrange the ERM toolkit and the video recorder, and how to take pictures of the participant. In the questionnaire, most of the students didn't want to have more time for the rehearsals (Figure 7.3).

Figure 7.2 A team in the rehearsal session

While most of the teams conducted the rehearsals fluently and seriously, some had difficulty in asking the questions and helping the 3D modelling process. After rehearsals, they stated that they had to read the interview schedule more carefully. The students felt more comfortable at the real ERM sessions after the rehearsals. They were able to work in a more collaborative way during the ERM sessions as they had experienced it before. The role of the rehearsals was critical that most of the students believed that rehearsal, division of labour and usage of toolkit were clear in the ERM (Figure 7.3).

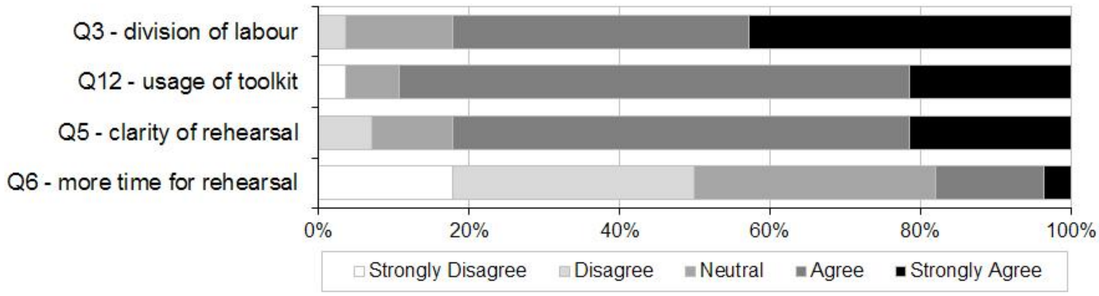


Figure 7.3 Percentiles of rehearsal and collaboration related responses

7.5 Integrating Video Clips into the ERM Presentation to Represent Teamwork

Video sections embedded into the ERM presentation was beneficial to inform the students about the ERM sessions, however, videos presented in the previous case were the ones that the researcher conducted individually. Thus, the students couldn't understand thoroughly what teamwork implied during the sessions. For that reason, two videos were included in the ERM presentation to give more information about the sessions. The first video was shown in fast-forward which was a whole ERM session of a student team from the previous year starting from setting up the environment and concluding with ending the session. In the second one, a small section of the whole was presented in a normal pace to help the students better understand what was going on during the session. Most of the students thought that selected videos in the presentation helped them understand the ERM session (Mode = 5, Q4, M = 4.43, SD = 0.69). Additionally, division of labour in the ERM sessions was explained during the presentation. Consequently, the students agreed that the division of labour in the ERM session was clear, since the ERM presentation gave clues about it (Figure 7.3).

7.6 Adding New Parts to the ERM Toolkit

In the previous implementation of the ERM, the participants created forms that weren't provided in the toolkit by using play dough. However, the material used for connecting parts (e.g. Tack-it, Blu- tack) was unpractical to connect play dough because of the weight of it. That decreased the pace of the 3D modelling phase as well as the involvement of the participants in the sessions. To this end, the forms that the participants created were analysed, and predefined forms were added to the toolkit. All of the participants used play dough to create spouts for their tea maker in the previous case (Figure 7.4). The shapes were analysed, and four parts were developed and added to the toolkit representing two diverse spout types. (Figure 7.5).

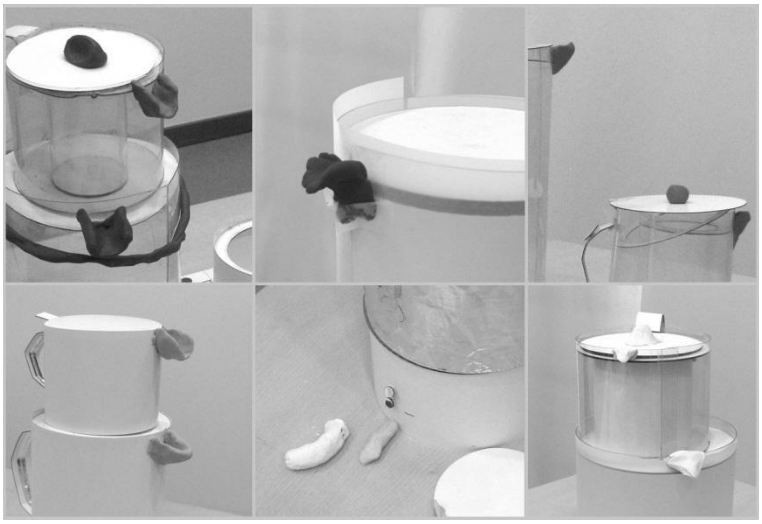


Figure 7.4 The way of using play dough to create spouts

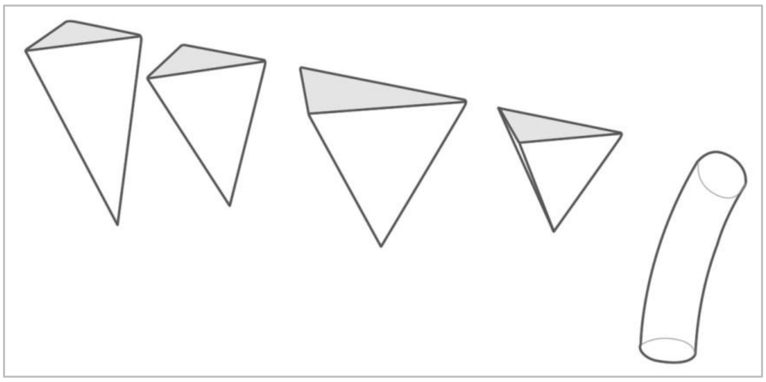


Figure 7.5 The 3D forms added to the ERM toolkit

Scenario cards were added to the toolkit such as “sunday breakfast”, “tea break at office” and “guest hosting” to enhance the involvement of the participants through enabling them to contextualize the most familiar usage scenario while responding to the questions. At the beginning of the ERM session, the participant was asked to select one of the scenario cards representing an occasion for which she/he used the electric tea maker frequently. Then, the participant demonstrated tea brewing and serving process for that particular occasion. Additionally, the toolkit used in the previous case included only one size 3D form representing tea glass. The students mentioned that diversity in the tea glasses were limited for their participant. Thus, two more sizes for tea glasses were included in the toolkit to enrich active involvement of the participant in the service related questions (Figure 7.6).

Figure 7.6 The sample toolkit for the ERM

According to the questionnaire, although the students agreed that abstract and basic parts in the toolkit supported active involvement of the participant, they couldn't reach an agreement on whether the parts and materials in the ERM toolkit were diverse enough for the participant to reflect her/his responses on the 3D model (Q14, Mode = 2, M = 3.43, SD =1.14) (Figure 7.7).

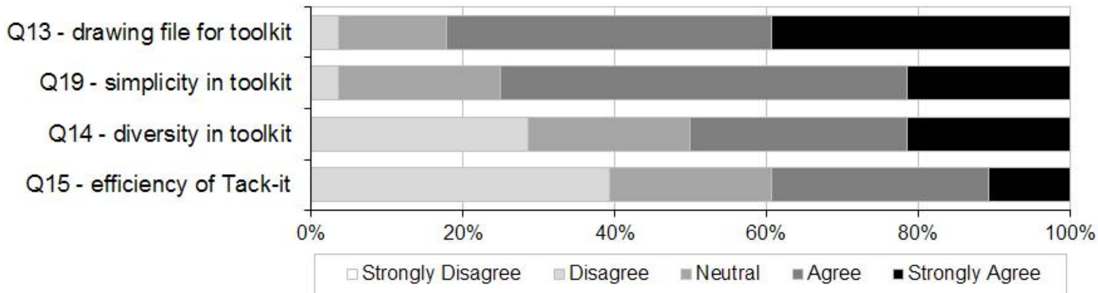


Figure 7.7 Percentiles of toolkit related responses

During the ERM sessions, the participants modified the toolkits due to their special needs such as drawing, scaling down the volumes by cutting, creating new forms by using play dough. However, some design students weren't satisfied with the realization of the product by using the toolkit provided. In the cases, the researcher observed that the 3D model as one of the main outputs of the sessions was perceived as the source of knowledge by some students. They might think that they could directly transfer the design details of the 3D models that their participants built during the sessions to their design ideas. Yet, 3D modelling is a medium helping participants recall and reflect their experiences and use context while expressing their needs, preferences and expectations. It also helps the students realize easily what the participants talk about.

The students also didn't agree that Tack-it was an adequate tool to connect parts in the toolkit (Q15, M = 3.11, SD = 1.07). Some teams had difficulty as they tried to use only putty-like adhesive material (i.e. Tack-it) to connect parts in the toolkit. The researcher observed that putty-like adhesives alone were insufficient to connect play dough to other parts in the toolkit. At some occasions, tape was also a good connector. Alternative solutions should be provided to connect parts in the toolkit.

7.7 Improving the Drawing File for the Toolkit

The students in the previous case mentioned that it was demanding to associate 3D forms in the toolkit with their surface developments. They had a lot of surfaces produced by laser cutter, and they had difficulty to bring together surfaces to create 3D forms. Additionally, the drawing file was prepared in Turkish, so the international students only benefitted from the sample toolkit that the researcher prepared. To this end, the drawing file was prepared in English and rearranged. Each 3D form was numbered and located with its corresponding surface developments (Figure 7.8). In the drawing file, there was a note giving information about the faculty workshop and laser cutter, and encouraging the students to add materials and parts as they wanted.

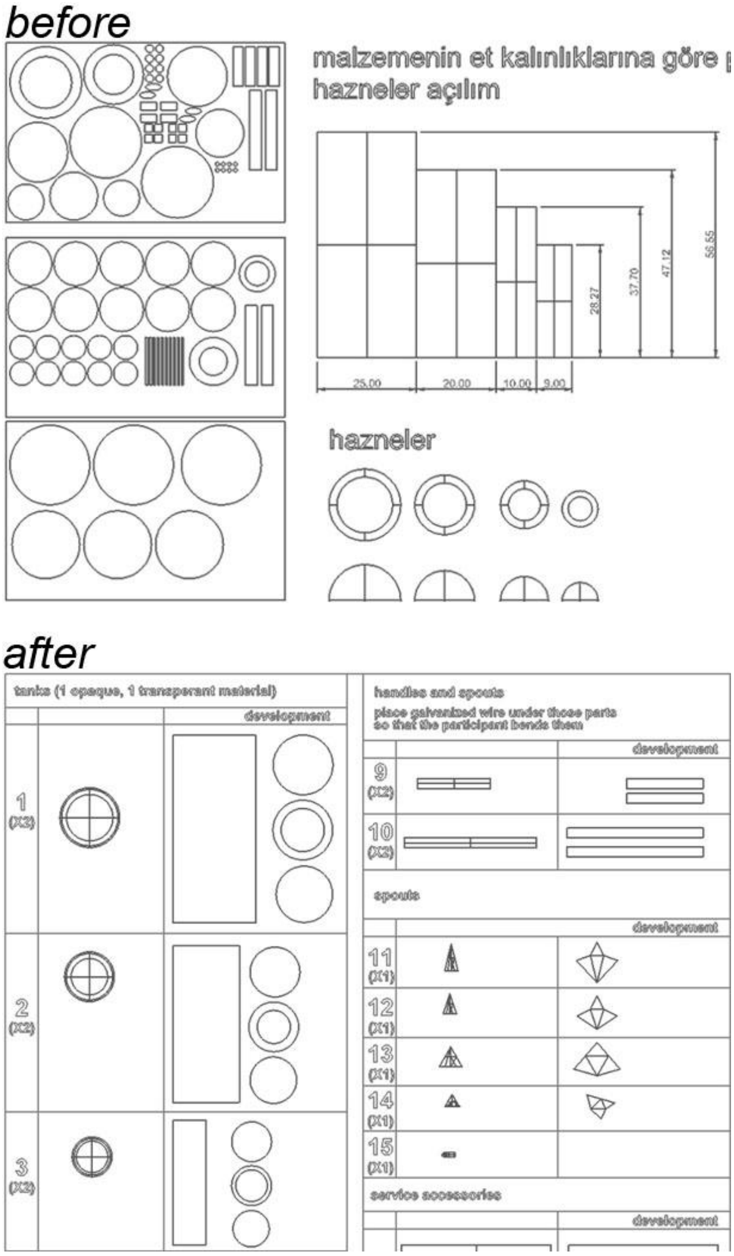
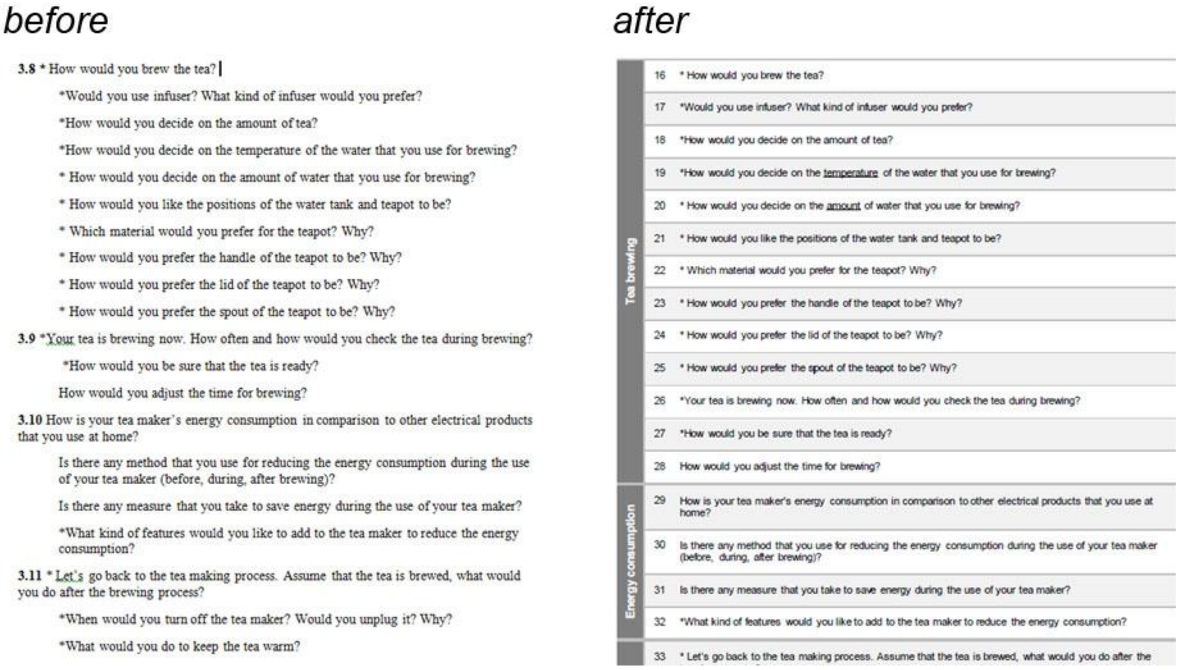


Figure 7.8 The differences of the revised drawing file from the previous one

The drawing file for the ERM toolkit was clear for all of the teams in this case. They mentioned that they didn't have any difficulty while preparing the toolkit, and the results of the questionnaire also supported that (Q13, Mode = 4, M = 4.18, SD =.82) (Figure 7.7).

7.8 Changing the Format and the Content of the Interview Schedule

To enable the students to easily follow, check and ask the questions, the format of the interview schedule was revised (Figure 7.9). Introduction part giving brief information about the research and the questions were presented at different sheets. Each question in the interview schedule was numbered, and grouped under particular topics such as preparation, tea brewing, energy consumption, after brewing, additional controls, tea serving, cleaning, maintenance, and additional features and improvements. At the beginning of the interview schedule, usage scenarios were presented to encourage the participants to respond to the questions based on a particular occasion that they were most familiar with (Appendix Z).



before

3.8 * How would you brew the tea?

*Would you use infuser? What kind of infuser would you prefer?

*How would you decide on the amount of tea?

*How would you decide on the temperature of the water that you use for brewing?

* How would you decide on the amount of water that you use for brewing?

* How would you like the positions of the water tank and teapot to be?

* Which material would you prefer for the teapot? Why?

* How would you prefer the handle of the teapot to be? Why?

* How would you prefer the lid of the teapot to be? Why?

* How would you prefer the spout of the teapot to be? Why?

3.9 *Your tea is brewing now. How often and how would you check the tea during brewing?

*How would you be sure that the tea is ready?

How would you adjust the time for brewing?

3.10 How is your tea maker's energy consumption in comparison to other electrical products that you use at home?

Is there any method that you use for reducing the energy consumption during the use of your tea maker (before, during, after brewing)?

Is there any measure that you take to save energy during the use of your tea maker?

*What kind of features would you like to add to the tea maker to reduce the energy consumption?

3.11 * Let's go back to the tea making process. Assume that the tea is brewed, what would you do after the brewing process?

*When would you turn off the tea maker? Would you unplug it? Why?

*What would you do to keep the tea warm?

after

Tea brewing	16	* How would you brew the tea?
	17	*Would you use infuser? What kind of infuser would you prefer?
	18	*How would you decide on the amount of tea?
	19	*How would you decide on the temperature of the water that you use for brewing?
	20	* How would you decide on the amount of water that you use for brewing?
	21	* How would you like the positions of the water tank and teapot to be?
	22	* Which material would you prefer for the teapot? Why?
	23	* How would you prefer the handle of the teapot to be? Why?
	24	* How would you prefer the lid of the teapot to be? Why?
	25	* How would you prefer the spout of the teapot to be? Why?
	26	*Your tea is brewing now. How often and how would you check the tea during brewing?
	27	*How would you be sure that the tea is ready?
	28	How would you adjust the time for brewing?
Energy consumption	29	How is your tea maker's energy consumption in comparison to other electrical products that you use at home?
	30	Is there any method that you use for reducing the energy consumption during the use of your tea maker (before, during, after brewing)?
	31	Is there any measure that you take to save energy during the use of your tea maker?
	32	*What kind of features would you like to add to the tea maker to reduce the energy consumption?
	33	* Let's go back to the tea making process. Assume that the tea is brewed, what would you do after the

Figure 7.9 The differences of the revised interview schedule from the previous one

Sequence of the questions might change according to the responses of the participant. Thus, the students asking the questions had difficulty to follow the sequence of the questions. To ease the process of following the questions in the schedule, one student was responsible for tracking and marking the questions. However, most of the students were neutral in the questionnaire that the interview schedule enabled them to follow the questions (Q9, Mode = 3, M = 3.96, SD = 0.84).

7.9 Changes on the ERM Analysis

The most fundamental change on the ERM was implemented into the analysis phase based on the findings from the previous field study. Through these changes, it was aimed to balance allocated time considering workload for each phase of the ERM, enable students to integrate personal knowledge and skills into various phases of the ERM, encourage the students to use the outcomes of the ERM at the idea generation phases, and support effective sharing through interaction among the students. The objectives of the analysis such as helping the students highlight inspiring and insightful statements made by the participants, identifying the potential solution areas, and sharing the results of the analysis remained the same. Yet, the format and the techniques were changed especially in the first part.

Besides, submission for the ERM analysis was divided into phases in order to balance the time dedicated to each phase. There were three submissions in the analysis phase such as video presentations, submission of insights and design solutions areas, and presentation boards.

7.9.1 Exemplifying Insights and Design Solution Areas

In the ERM brief of the previous educational case, the definitions of insights and design solution areas weren't stated clearly. In this case, it was aimed to exemplify them by the presentation and the brief. In the presentation, the insights were presented after showing a short video section from the ERM sessions. Furthermore, it was stated as "develop and provide insights that are the interpretations of the participants' statements in the video sections", and the examples were given with the images representing the presentation formats. For instance, in the video clip presented to the students, the participant was using a samovar type tea maker, and she had some difficulties in serving tea because of the height of the tap. She was locating the tea maker on the edge of the counter to place the tea glass under the tap. She also mentioned that she couldn't use all of the water inside the water tank since the tap was placed higher compared to the water level (Figure 7.8).

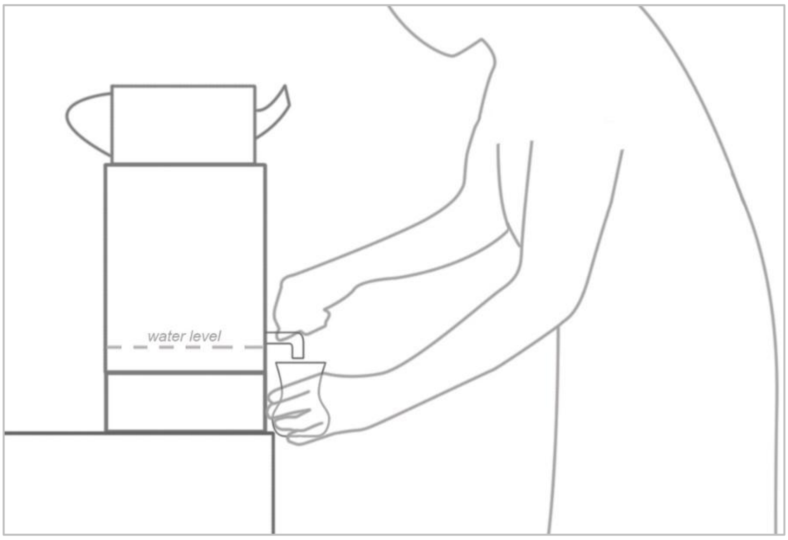


Figure 7.10 Representation of the participant's experience presented in the video clip

As a response of this experience that the participant expressed during the session, some interpretations were made by the researcher, and presented in the ERM brief and the presentation to exemplify means of providing insights. Those were:

- The spout of the water tank can enable the user to pour the water inside efficiently.
- The height of the spout should be arranged in a way that the user can locate the tea glass easily while serving.

Another example was provided to explain design solution areas. In this example, an insight was given with the potential design solution areas. The insight was "controls and displays can give sensorial feedback for informing the user during brewing process". The design solution areas developed for this insight were "speaking teapot, friendly feedback, assistive tea maker, personalized feedback, and master of taste."

Based on the observations of the analysis phase, the questionnaire and the interviews, the teams couldn't totally comprehend how to interpret their participants' statements, and how to develop potential design solution areas. In some cases, they could not figure out the difference between insights and design solution areas. Thus, they adopted their participants' solutions for their insights rather than understanding and interpreting the participants' needs, expectations and preferences for providing inspirational insights. For instance, the participant of a team mentioned that she/he preferred buttons on the handle since it was easy to control while serving tea. The team gained insight on this such as "controls can be easier to use if they are placed on the handle rather than on the bottom of the tea maker." This insight would limit the students to place the controls on the handle. However, providing an insight such as "the controls and displays should be located in a way that the user can easily access and use" would encourage the students to think beyond locating them on the handle through exploring potentials of the location and potentials of different control types such as push, rotary, touch, et cetera.

On the other hand, the teams might develop too broad design solution areas that resulted in generating ideas disconnected from the data. For example, the participant of another team was worried about hygiene of the countertop when she/he put the parts of the tea maker such as lid, infuser. The team developed two diverse design solution areas based on this such as "minimum touch points between parts" and "user-friendly material." In the former one, the solution area had the potential to trigger the students' creativity to develop diverse design details. However, in the latter one, the design solution area was so broad that it started to disconnect from the context and the original source of data. The questions such as "User-friendly in terms of what, for whom, why?" started to emerge. It also became irrelevant in terms of design considerations, since the students were not clear about how to relate it to the design considerations.

Giving one or two examples weren't enough to explain how to interpret and develop design solution areas, so the students couldn't reach an agreement on the clarity of insights (Q28, Mode = 2, M = 3.25, SD = 1.11) and design solution areas (Q29, Mode = 3, M = 3.21, SD = 1.07) described in the ERM brief. A few more exercises may be conducted with the students to better present the characteristics of insights and design solution areas in relation to design considerations. From the statement of the participants to the design solution areas, step by step, the process should be exemplified to better clarify these terms.

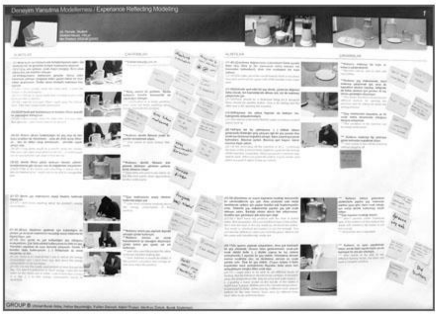
7.9.2 Enabling Students to Develop Design Solution Areas under Project Considerations

In the previous case, the students selected video sections from the ERM sessions without considering the design considerations in the project brief. Therefore, the students had difficulty to associate their design solution areas with the project considerations in the second part of the analysis. At the beginning of the ERM analysis phase of this case, the student teams selected 10-12 video sections considering three main project design considerations that they found important from the video recording of the ERM session. By this way, the students were encouraged to develop their design solution areas under the design considerations to better relate the solutions with the project considerations. Most of the students agreed that their design solution areas were related with the given categories according to the questionnaire results (Q38, Mode = 4, M = 3.68, SD = 0.72).

7.9.3 Presentation Format of the First Part

Unlike the previous presentation posters, the teams prepared video presentations (VP) which presented selected video sections from the ERM and insights gained into these video sections based on the project considerations (Figure 7.11).

before



after

Figure 7.11 The differences of the revised format for the first part of analysis from the previous one

Compared to textual and symbolic representations, video recording helps students better understand what actually happens during the ERM sessions. Video recording is a communicable medium which enables each student in a team to participate in interpretation through exploring detailed data. However, for an effective co-interpretation, each student in the team needs to feel comfortable and think that she/he is being listened rather than being evaluated. (Ylirisku & Buur, 2007). To provide communicable platform for knowledge sharing and co-interpretation, a video presentation format was provided for the first part of the ERM analysis. It aimed an effective way of sharing in order to help the students understand diverse user profiles for idea generation. By this way, the students were able to see other teams' sessions and to review other teams' participants' statements. Hence, they had the chance to review and access other teams' interpretation about these statements.

To give information about the video presentation format, a section from a video presentation that the researcher prepared in advance was presented to the students during the ERM presentation (Figure 7.12). Furthermore, the researcher gave a short lecture about how to use a video editing program (i.e. Windows Movie Maker) that could be used for the video presentations. However, the students were allowed to choose any kind of software to edit the video recordings. Most of the teams used Sony Vegas, since they had learned that software before, in a design course. The teams presented their video presentations with English subtitles (for the sessions conducted in Turkish); and developed and provided insights that were the interpretations of the participants' statements in the video sections. The presentations lasted approximately 20 minutes.

Figure 7.12 Sample video snapshot from the VP

Video presentations included participant information (i.e. age, gender, occupation, year of experience with the product), images of the electric tea maker and the serving set that the participant actually used in daily life and modelled during the session, and selected video sections with English subtitles along with their insights.

There were both advantages and limitations of video presentation format in the ERM analysis. Video presentations were captivating than text-based presentations. They helped the students better understand the participants, and supported the ERM analysis and idea generation phases (Figure 7.13, Q33R, Q36R, Q42R, Q65N). The students benefitted from video presentations (Figure 7.13, Q51R) by taking notes during the presentations. They thought that watching and taking notes were easier than reading texts. How to prepare a video presentation was also clear for the students (Figure 7.13, Q62N). However, the teams spent so much time on editing the video and adding subtitles. It was demanding to bring together the relevant video sections in which the participant talked about the same topic. Although the teams worked together in many phases of the ERM, the video recording for the presentations was edited mostly by one student in the team. Quality of the video presentation was dependent on the skills of the student who was responsible for editing. According to the students, they had difficulty to associate the video clips with the corresponding insights provided in other teams' presentations. The main reason was that some teams weren't successful enough in video presentations because of skills in video editing or time limitation. To improve this phase further, the students suggested that oral presentations could be added at some stages of the video presentations which might encourage discussion about the participants' responses on selected topics.

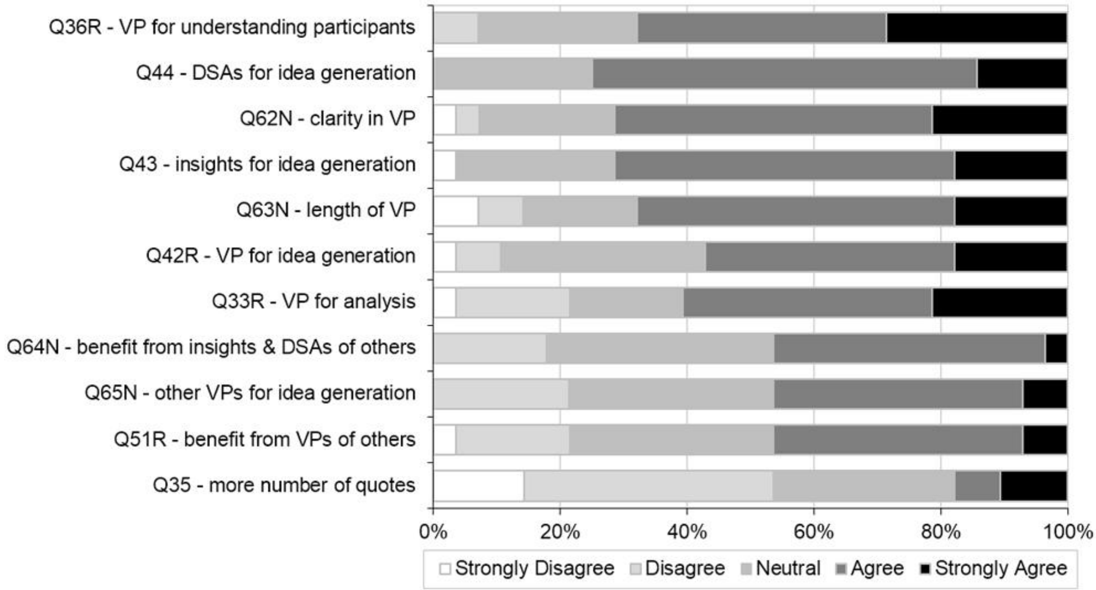


Figure 7.13 Percentiles of first part of the ERM analysis related responses

It is worth considering that video presentation is an effective medium to share knowledge and to make co-interpretations. Since it requires plenty of time, phases of video presentation can be developed further to ease workload particularly during the video editing process.

At the end of the video presentations, the teams compiled and submitted their insights with corresponding images from the sessions based on the format provided (i.e. A4 sheet of paper) (Figure 7.14). Then, they wrote down their potential design solution areas based on the insights. The A4 sheets were hanged on the boards at the design studio, and each student reviewed the design solution areas and corresponding insights. For the second phase of the ERM analysis, the teams were allowed to select inspiring design solution areas from any team. It was aimed to encourage the students to be aware of each team's interpretations and to provide a knowledge sharing platform for the second phase of the analysis.

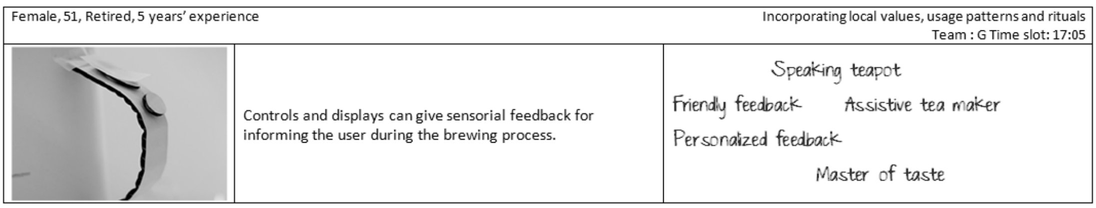


Figure 7.14 Submission format of insights and design solution areas

During the observations, the students mentioned that they mainly used their design solution areas at the second phase of the analysis, however they benefitted from other teams' DSAs if they were inspiring for them. According to the questionnaire results, most of the students agreed that they benefitted from other teams' insights and design solution areas (Figure 7.13).

7.9.4 Presentation Format of the Second Part

After reviewing and selecting the design solution areas, the student teams arranged the DSAs under three main sustainable design considerations. Some solution areas were related to more than one design consideration. Then, they presented their initial ideas through quick sketching in relation to the design considerations as exemplified in the sample analysis poster format. Better associations between the design solution areas and sketches in the sample poster were provided to guide the students how to connect those visually. The size of the presentation board was extended as 100*140 cm in order to provide more space for the students' sketches (Figure 7.15).

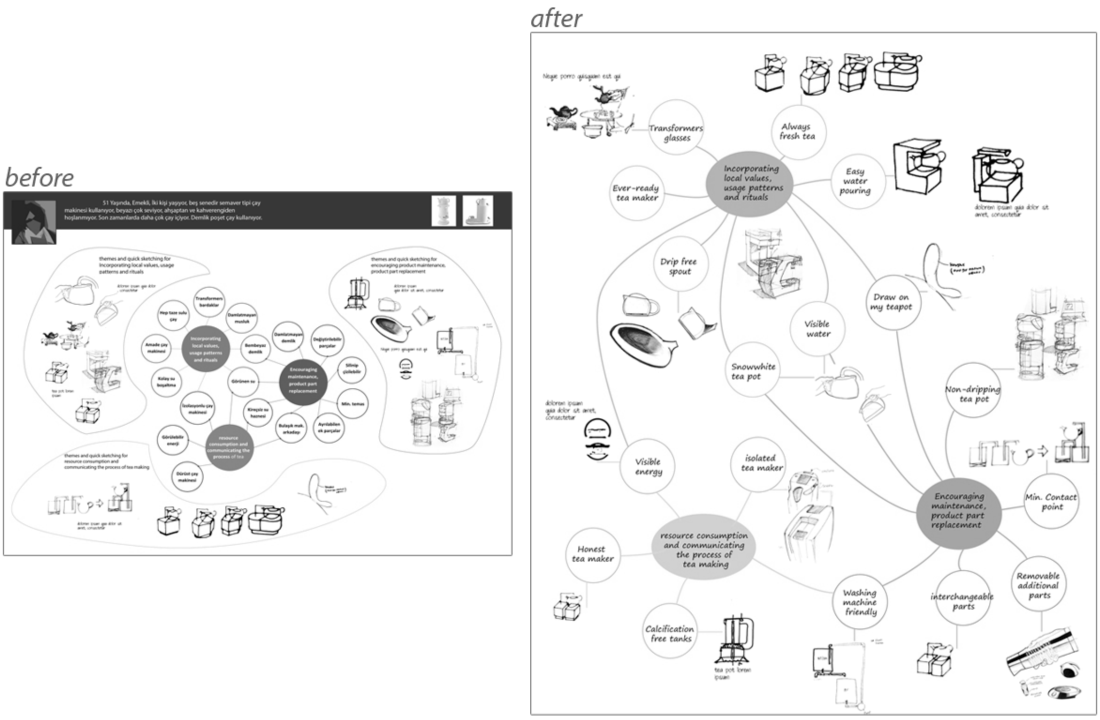


Figure 7.15 The differences of the revised sample poster from the previous one

The presentation boards included categorization of the potential DSAs under three main project considerations with initial sketches. The sample poster enabled the students to develop their unique posters (Q46, Figure 7.16).

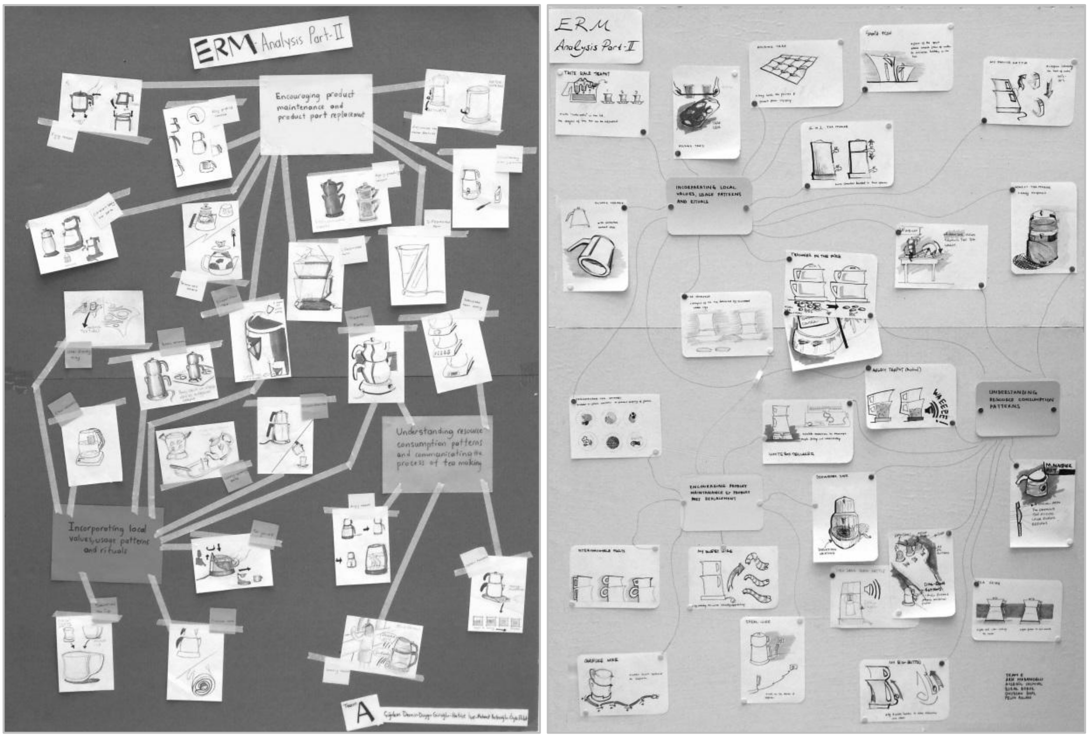


Figure 7.16 Analysis posters of Team A and Team E

According to the questionnaire and interview results, sample poster enabled the students to understand the second part of the analysis phase. They didn’t have difficulty in placing the design solution areas related to more than one category on the analysis posters, and locating the sketches related to more than one design solution areas on the analysis posters. Furthermore, some of the materials for the analysis posters were completed, as the teams had already submitted their insights and design solution areas. Allocated time for the posters was a day (i.e. 8 hours at studio). Although the teams mentioned that the time was sufficient for the second part of the ERM analysis, the questionnaire results showed that there wasn’t a consensus about this topic (Q59, Mode = 2, M = 3.46, SD = 1.29) (Figure 7.17).

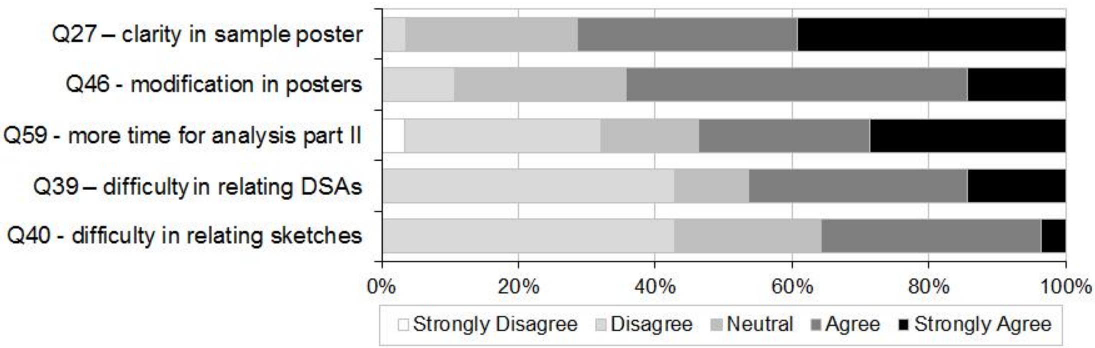


Figure 7.17 Percentiles of second part of the ERM analysis related responses

After completing the presentation posters, a short presentation was conducted at the studio to share the outcomes of the analysis. During this presentation, each team presented the design solution areas and initial ideas that they found most inspiring (Figure 7.18).

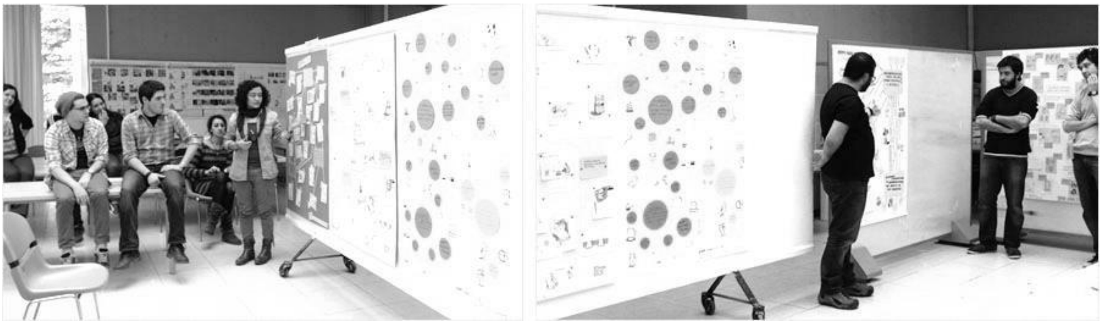


Figure 7.18 Presentation of the ERM analysis posters

The students revealed that the presentations were useful to benefit from other team's posters during idea generation. However, they were so tired to listen, and not all of the ideas were presented in a limited time. However, according to the questionnaire results, most of the students didn't want more time for the presentation of other teams' posters (Figure 7.19). They believed that they could look at the posters whenever they wanted, since they were hanged on the boards at the studio for a while.

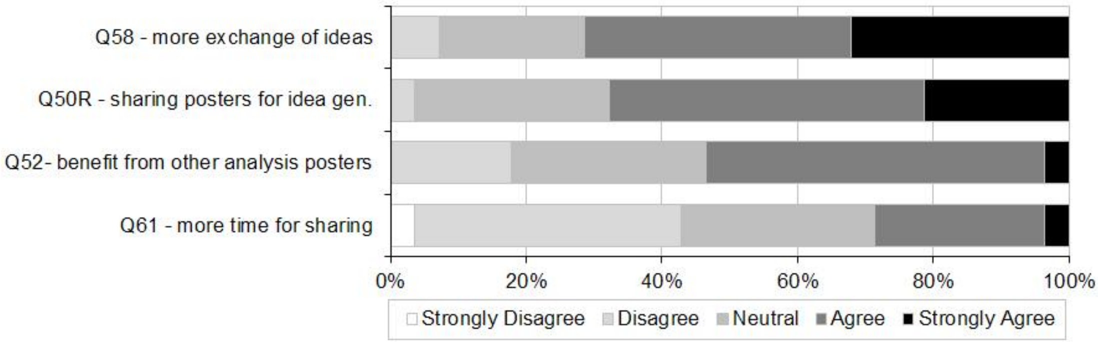


Figure 7.19 Percentiles of sharing related items

Implications of the ERM for the Matrix. Implication of the ERM for idea generation phases wasn't the subject of this field study, however the students mentioned about it during the interviews. Although most of the students agreed in the questionnaire that the ERM supported the Matrix exercise (Q53, Mode = 4, M = 3.71, SD = 0.98), there were diverse opinions about it. Briefly, some students believed that the ERM supported the Matrix to some extent. They overviewed again and again their ERM analysis posters and others' as well. However, some students thought that the ERM didn't support the Matrix exercise to a greater extent, since they couldn't associate the themes and dimensions in the Matrix with the design solution areas in the ERM. The themes and dimensions were determined by the studio tutors based on the outcomes of the ERM. Involving the students in this process can be encouraged so that the students better internalize the themes and dimensions, and relate these with the ERM analysis.

Few students felt uneasy about getting inspired by someone's idea. So, they mentioned that they didn't want to benefit from the analysis posters. The Matrix incorporated into this educational case was conducted individually rather than teamwork unlike the previous case. This concern of the students might have resulted due to that reason.

Throughout the doctoral study, the ERM was implemented into various educational cases. During this process, observing the students' attitudes and responses towards the ERM and understanding their opinions and reflections regarding it were greatly valuable to develop and improve the method further. The ERM was developed gradually based on the findings from the primary research cases. The prominent issues to develop the ERM based on the conclusions of this field study are:

- clarifying the ERM as a knowledge generating method with participants rather than designing with them
- increasing diversity in the toolkit
- defining and exemplifying insights and the design solution areas for the first part of the analysis
- providing guides for video presentations to reduce workload for editing
- supporting effective sharing platforms through interaction among the student teams
- better relating the following idea generation exercise (e.g. Matrix) to the ERM analysis

In the conclusion chapter, my reflections on the relationship between graduate research and design research, and the current state of the ERM method aligned with student engagement will be presented considering its potentials and limitations in design education at undergraduate level.

CHAPTER 8

CONLUSION

In this chapter, reflections on design research based on the doctoral study, guidelines for the implementation of the ERM into design education as a generative research method which enriches student engagement, the limitations of the ERM implementation in this study, future adaptations of the ERM for design education, and suggestions for the further research will be presented.

8.1 Looking Back on Design Research

Research should be purposive and goal-directed, inquisitive and knowledge directed, informed, methodological and systematic, and communicable (Friedman, 2003; Cross, 1999; Archer, 1995). The design research within the context of this doctoral study was *purposive* and *goal-directed*, since it was initiated by the problem definition and research questions. It was *inquisitive* and *knowledge-directed* since it was aimed to acquire new knowledge through interpretation of information retrieved from the data. It was *informed* since the following researches were shaped by the findings of the previous researches. It was *methodological* and *systematic* since it followed a structured path in terms of research plan, data collection, analysis, and presenting the results. It was *communicable* since the findings were reported in a way that the reader could understand, assess it, and even implement the ERM into an educational platform.

The researches which have been conducted within the context of the doctoral study can be compiled under a holistic design research framework. Various research approaches (i.e. ethnography, field research, case study, domain-specific research, action research, methodological research) were brought together in the context of the dissertation, and a design research model was developed (Figure 8.1).

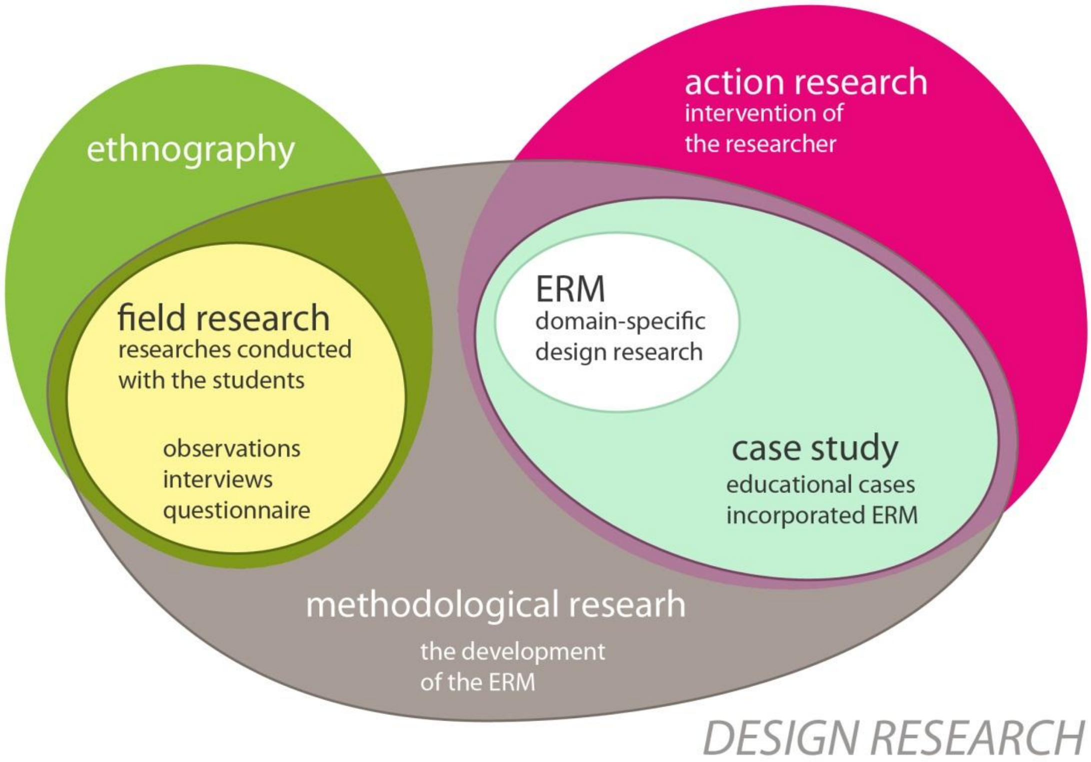


Figure 8.1 The design research model in this dissertation

In this thesis, *methodological research* approach was the main structure of the design research. It implies the process to develop generalized knowledge through theories, methods and tools, which is relevant for practical applications in different design cases (Poggenpohl & Sato, 2009). In this study, methodological research aimed to develop the ERM method through implementing it in various educational cases, gaining feedback from the students about it, and assessing the method based on the findings.

Action research links research and practice. Both research and practice inform each other through an iterative process including the researcher and other active actors as well (Avison, et. al., 1999). Action research in this study embraced the educational cases incorporating the ERM method. In this process, the studio tutors, the design students and their participants played an active role beside the researcher. The researcher was not only an observer or explorer, she also intervened in the process at particular stages for the integration and development of the ERM such as developing the project briefs, proposing changes for the ERM, guiding the students in particular phases of the ERM. Design knowledge for the development of the ERM was generated through incorporating insights and reflections by active involvement of the researcher.

Design research is a "knowledge-generating foundation for the design discipline" (Poggenpohl & Sato, 2009, p.27). Poggenpohl and Sato (2009) define design research as domain-specific design research and general design research. The subject of this design research, the ERM, was also a *domain-specific design research* conducted by the design students. It can also be named as clinical research (Friedman, 2003; Frankel & Racine, 2010), and research for design (Frayling, 1993; Archer, 1995). It indicates that the research for developing information for a specific design project (Poggenpohl & Sato, 2009). In this thesis, this information implies user's needs, preferences and expectations regarding a product. The knowledge generated through the methodological research informed the domain-specific research (i.e. ERM) and enabled the researcher to develop it sequentially.

Within the framework of the design research, many field studies were conducted through the educational cases. The tools and techniques used in these field studies such as interviews, observations and questionnaire were adopted from ethnography. These field studies helped the researcher support her observations related to the ERM.

Through a more holistic approach, each research phase informed and inspired each other to generate explicit knowledge. This also helped develop and integrate the ERM into industrial design education as a generative research method which enriched students' experience of engagement in research phase of design process at undergraduate level. The information retrieved from the design research was scrutinized systematically and methodologically to develop explicit knowledge. Tacit knowledge acquired from the designer role of the researcher supported many stages of the design research as mentioned at the methodology chapter. Hence, both tacit and explicit knowledge were used in this design research.

In the next section, the factors effecting student engagement in the ERM and the ERM guidelines align with these factors will be presented for the readers who wish to implement it into design projects.

8.2 Student Engagement in the ERM Phases

Proceeding the ERM method with full engagement of students is essential to provide an effective learning environment in design education. Student engagement in the ERM refers to being engaged and attentive at each phase of the ERM. Enhancing engagement encourages design students to perform the tasks in the phases and to adapt their skills and knowledge gained from the ERM in the future. Various factors affecting student engagement in the ERM method has been discussed in Chapter 6. Some of them are peculiar to the ERM method itself such as diversity in the toolkit, tangibility etc., whereas some are related to the educational process such as clarity, time planning, et cetera. From a wider perspective, each factor is closely related to each other.

Clarity in the ERM method implies understandibility and comprehensibility throughout the ERM. It includes clarity of the ERM brief, the introductory presentation explaining the ERM phases, the project considerations incorporated into the ERM, and the definitions of insights and design solution areas developed during the ERM analysis. It is also associated to *time planning* and *professionalism* in the ERM. *Time planning* includes all scheduled phases and submissions of the ERM method such as allocated time for toolkit preparetion, sessions, analysis and sharing phases. *Proffessionalism* refers to doing a professional task like a rehearsal of future career life. Documentation of the ERM session, arranging a particular environment for the session enables the students to feel that they are conducting a professional research phase in design process. *Clarity*, *time planning* and *professionalism* are the issues that should be mainly considered during the preparation phase of the ERM. Design educators should be aware of these for the planning of the ERM method.

Teamwork and *collaboration* are interrelated factors affecting student engagement. They are both in the ERM session and analysis phase of the ERM. It might be difficult to intervene teamwork dynamics in student teams. Each team can approach to the collaboration or division of labour differently, however we can provide effective mediums to enhance teamwork. To achieve collaboration among student team members during the ERM session, rehearsing the session in advance gains importance. Rehearsals prime students for the interviewing, 3D modelling and documentation phases for the real ERM sessions. The tools and techniques used in the analysis phase encourage collaboration in teams and awareness of each team member's opinions about the interperetation of the participant's statement. Diversity of opinions and ideas of each team member enriches the analysis phase of the ERM.

Tangibility in the ERM sessions refers to tangible 3D model that the participant build up during the session by using the toolkit provided. Tangibility helps students envision what the participant talked about in the ERM sessions. The level of exploration and reflection through 3D modelling depends on the diversity of the toolkit, and the relationship between the interviewing and modelling phases. *Diversity in the toolkit* enriches active involvement and *reflection of the participant*; however these are also related to the background of the participant in terms of use experience, knowledge about the particicular product and enthusiasm to give detailed information. Thus, recruiting an experienced and attentive participant for the ERM sessions gains importance.

Interaction between student teams is also a factor encouraging student engagement during the ERM. Since the teams conduct the ERM session independent from each other, the only interaction platforms for them to reveal their experiences and findings are the analysis and the sharing phases of the ERM. Interaction in the first phase of the ERM analysis helps students understand diverse user profiles beyond their participants while interaction in the sharing phase facilitates them to explore and evaluate various design solution areas and ideas developed by other teams for idea generation.

Although the ERM requires teamwork, students work as individual in some phases such as sketching in the ERM analysis. *Individual work* in the ERM analysis encourages students to develop diverse ideas and to bring together their tacit design knowledge with explicit research knowledge. As the students conducts idea generation phase individually for the further phases of the project, individual work in the ERM has the potential to bridge research with idea generation phases. The ERM analysis should enable individual work beside *teamwork*, *diversity in the ideas* and *integration of tacit knowledge* into user knowledge to increase student engagement in the ERM phases.

8.3 Guidelines for the Implementation of the ERM Method

This section provides guidelines for the educators who would like to incorporate the ERM into an educational project. The phases and supplementary materials used in the ERM will be explained step by step with the instructions and suggestions. The phases are presented in Figure 8.2 along with the most significant factors effecting student engagement in the ERM. Within the scope of the doctoral study, the limitations for the implementation of the ERM and its future adaptations will be discussed after presenting the guidelines.

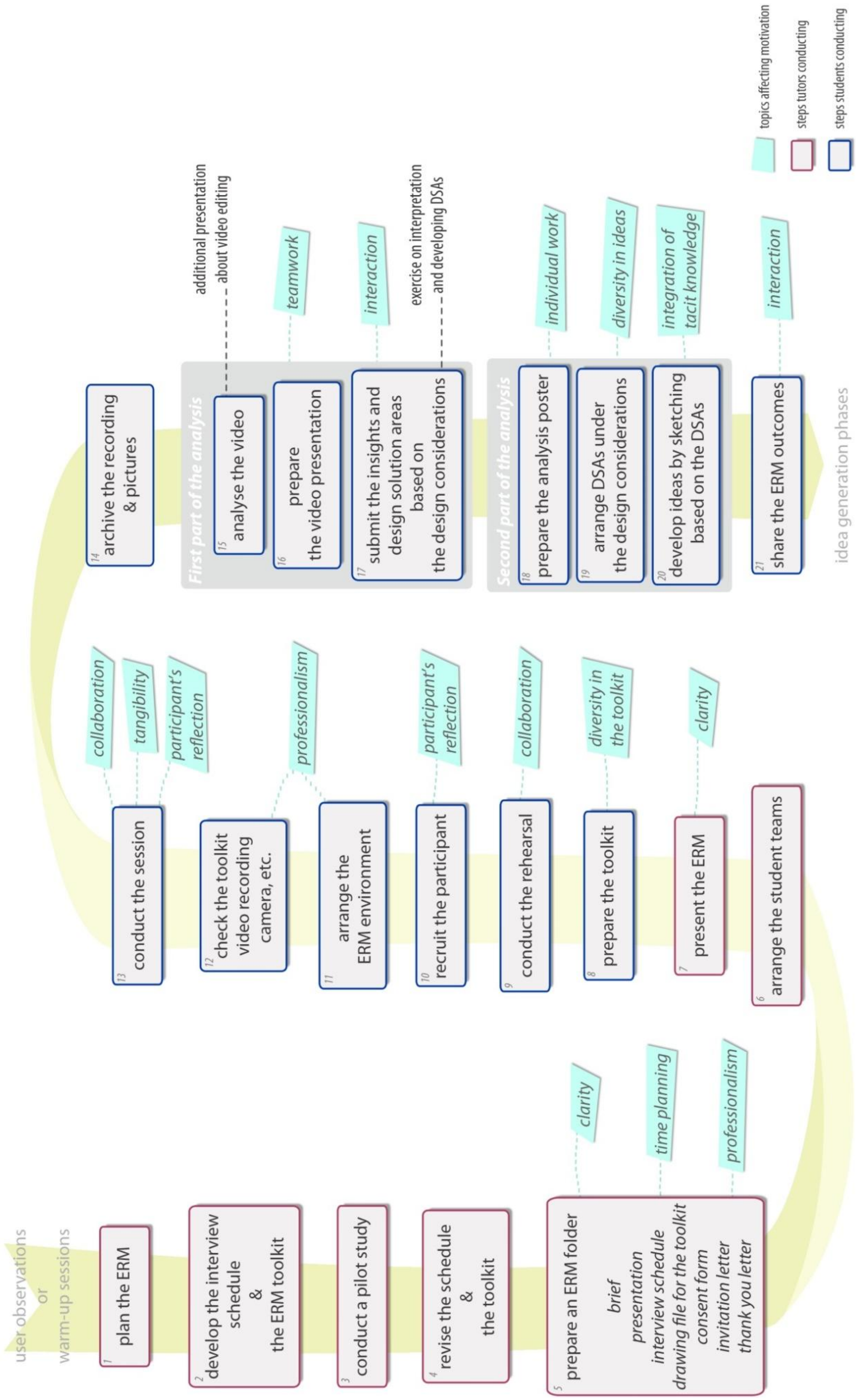


Figure 8.2 Steps to be followed for the implementation of the ERM

8.3.1 Planning the ERM and Preparation for the Sessions

The ERM helps students understand users' needs, experiences and expectations regarding a product, and develop design ideas based on user knowledge and design considerations along with integrating their tacit knowledge and design skills. It would be most effective if this method is applied to product based projects in second or third year industrial or product design studios at undergraduate level.

Planning the ERM. The project into which the ERM is incorporated requires a project brief clearly defining design considerations and design phases. Explaining the design considerations in the project brief is critical, since these will be taken into consideration during particular phases of the ERM such as interviewing and analysis. The ERM bridges the gap between human-centred research (e.g. user observations) and idea generation phases in the project, thus it can be scheduled between these. In the cases of this study, user observations were conducted to enable the students to be familiar with the use context of the product and to prepare the participants for the ERM sessions. In some cases, warm-up sessions instead of user observations or after the user observations might be recommended to prime the participants for the research topic.

Duration of the project was nine weeks for the first case and thirteen weeks for the second and third cases. In each case, allocated time for the ERM was approximately two and a half weeks. Assuming that the ECTS credit of the design studio is nine, at least two weeks are needed if the phases of the ERM will be followed completely (Table 8.1); however the duration can be flexed according to the duration of the project, ECTS credit of the course, and the number of the students attending the project. The ERM was conducted with the student teams of four, five and six students. Considering workload and collaboration, a team of four students is sufficient to conduct the ERM.

Table 8.1 *Estimated time for the ERM phases (prepared for the courses with 9 ECTS credit and 6-7 student teams)*

Introduction & toolkit preparation	2-3 days
Rehearsals	30 min. per a team
ERM sessions	90 min. per a team
First part of the analysis	3-5 days
Second part of the analysis	1-2 days
Sharing outcomes	30 min. per a team

Conducting a pilot ERM session. Before starting the ERM, conducting a pilot session with the contribution of the studio tutors is recommended (Figure 8.3). The pilot session is important to evaluate the interview schedule and the toolkit, and to help the tutors internalize the ERM sessions before presenting it to the students. A real user should be invited as the participant to the pilot session. This session will also provide exemplary video recordings that will be shown to the students during the ERM presentation.

Figure 8.3 Snapshots from the pilot sessions that the researcher conducted with her studio colleagues

Preparing the ERM folder. Studio tutors are advised to prepare an ERM folder for the students. This folder contains an ERM presentation, an ERM brief, an interview schedule, a drawing file for toolkit, invitation and thank you letters for participants, and a consent form. In my experience, I needed at least three weeks prior to the ERM, however you could be inspired by and benefit from the materials that I prepared for the cases with the help of the studio team (Appendices S, Y, Z, AA & BB).

The ERM brief should involve descriptive information about the method. It clearly explains the aim of the ERM, the ERM phases and their descriptions, and the submissions in detail (i.e. date, formats, and examples). The presentation for the method covers the information given in the brief through providing more visuals. It also presents video clips from the pilot session, or examples from the ERM phases conducted if applicable (e.g. video clips from the sessions and video presentation from the analysis, pictures of analysis posters, etc.). Presenting a video clip from a session at the beginning of the presentation helps students better understand the content and the outlines of the ERM. The ERM presentation is planned before the ERM starts, however, prior to the analysis phase an additional presentation can be made to remind the analysis procedure, and to demonstrate how a video presentation can be prepared. Before the presentation, all of the files in the ERM folder need to be handed out to the students to enable them to review the files while you are presenting (Figure 8.4).

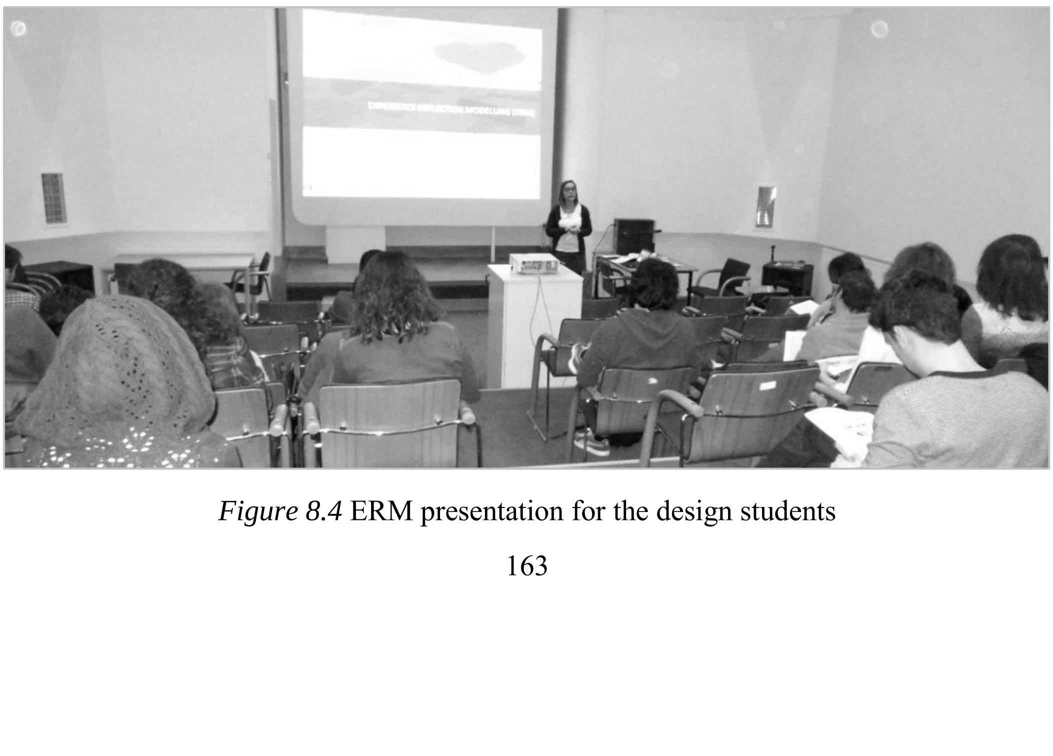


Figure 8.4 ERM presentation for the design students

Developing the interview schedule. It includes brief information to students and participants, and questions related to a lifespan of a product. Lifespan refers to *before use* (preparation for the use), *use*, *resource consumption* (if the product consumes energy or water during usage), *after use* (finishing the use, storage, etc.), *cleaning or maintenance* of the product. Moreover, questions about additional features and improvements regarding the product are included in the interview schedule. Table 8.2 presents types of questions for the development of the interview schedule. For each implementation of the ERM into the educational case in this thesis, type of the questions was based on the guidelines in that table.

Table 8.2 *Types of questions in the interview schedule*

preparation	Before starting let's select a scenario which represent an occasion for which you use *the product* frequently. Some examples would be …. Let's demonstrate *the process* for that particular occasion. Before starting *the process*, let's decide on the main parts of *the product*. How would be the relationship between these parts? , Why? What kind of preparations would you make before using *the product*? Could you explain *the use process* with the help of the 3D model? [*After that, the sequence of questions might change according to the sequence of the participant's use process.*] Which material would you prefer for the parts of *the product*? Why? How would you like their appearances to be? Why? Would you prefer something else? Why? [*During the process, this questions will be repeated for each part of the product*]
use process	When would you turn on *the product*? How would you turn it on? Assume that you turn on *the product*. How would you be sure that it is on? Would you prefer something else to be sure that it is on? Why? How would you adjust the settings during *the use of the product* (e.g. time, temperature, mode, etc.)? What kind of settings would you like to adjust? What kind of features would you like to add to *the product* regarding the settings? *The product* is processing now. How often and how would you check *the product* during *the process*? How would you be sure that *the process* is complete?
resource consumption	How is *your product's* energy consumption in comparison to other electrical products that you use? Is there any method that you use for reducing the energy consumption during *the use of your product* (before, during, after use)? Is there any measure that you take to save energy during *the use of your product*? *What kind of features would you like to add to *the product* to reduce the energy consumption?
after use	Let's go back to *the use process*. Assume that it is completed, what would you do after *the use process*? When would you turn off *the product*? Would you unplug it? Why? Is there any problem that you have experienced with *your product* during the use? What kind of features would you like to add to the product to improve *the use process*? Is there any feature that you would like to add in terms of displays and controls? Why?
cleaning or maintenance	How would you clean *the product*? What kind of difficulties do you face during the cleaning process? What kind of features would you like to add to *the product* for cleaning? Has *your product* ever been broken before? Or have you ever taken it to a technical service before? Why? Is there anything you do to prevent any potential damage to *your product*? Why? Is repair and maintenance important for *this product*? Why? Have you ever experienced any accident related to *your product*? What kind of features would you like to add to *the product* to prevent accidents? Assume that you have been using *this product* for a long time and you think that it is outdated. If there is an opportunity to renew *the product* without discarding it which parts would you like to replace or renew? Why?
additional features and improvements	What kind of new features would you like to add to *this product*? What kind of improvements would you make for *this product*? [*The participant may need time to answer these questions. The features that the participant has added to the product during the session are reminded by the researcher, and the question is asked again.*] Considering the whole process, is there anything that we haven't mentioned or missed about *the product*?

Format of the interview schedule should enable the students to easily follow and read the questions. The teams can add questions to the interview schedule if they want. The questions should be developed based on the design considerations in the brief, and every question should be asked in separate statements. Some question examples from the third case and how they relate to the considerations with the lifespan of the product are presented in Table 8.3.

Table 8.3 *Example questions from the interview schedule for the third case relating sustainability considerations*

	incorporating local values, usage patterns and rituals	**encouraging product maintenance and product part replacement**	**understanding resource consumption patterns and communicating the process of tea brewing**
Before Use	What kind of preparations would you make before brewing tea with the electric tea maker?	Which material would you prefer for the water tank? Why?	How would you decide on the amount of water in the water tank?
Use	How would you brew the tea?		How would you decide on the temperature of the water that you use for brewing?
After Use	Assume that the tea is brewed, what would you do after the brewing process?	What kind of features would you like to add to the tea maker for cleaning?	What would you do to keep the tea warm?
Resource Consumption			What kind of features would you like to add to the tea maker to reduce the energy consumption?
Cleaning or maintenance		If there is an opportunity to renew the tea maker without discarding it which parts would you like to replace or renew? Why?	

Developing the ERM toolkit and the drawing file. An ERM toolkit composes of 2D and 3D parts which have the potential to represent particular components of a product. Each student team should prepare their own toolkit since they would use them during the rehearsals and the sessions. These parts are developed through abstraction the product focused in the design project. Figure 8.5 partially illustrates the development of the toolkit for the electric tea maker projects (Cases II and III). For the abstraction of the product, you can start with a typical product in the market, and then abstract the parts on the product. Abstractions can start with the 2D drawing, and then they are developed as the 3D parts in the toolkit. For the drawing file of the toolkit to help students prepare their toolkits, each 3D part should be unfolded to create surface developments. I used a software program namely Rhinoceros for the surface developments.

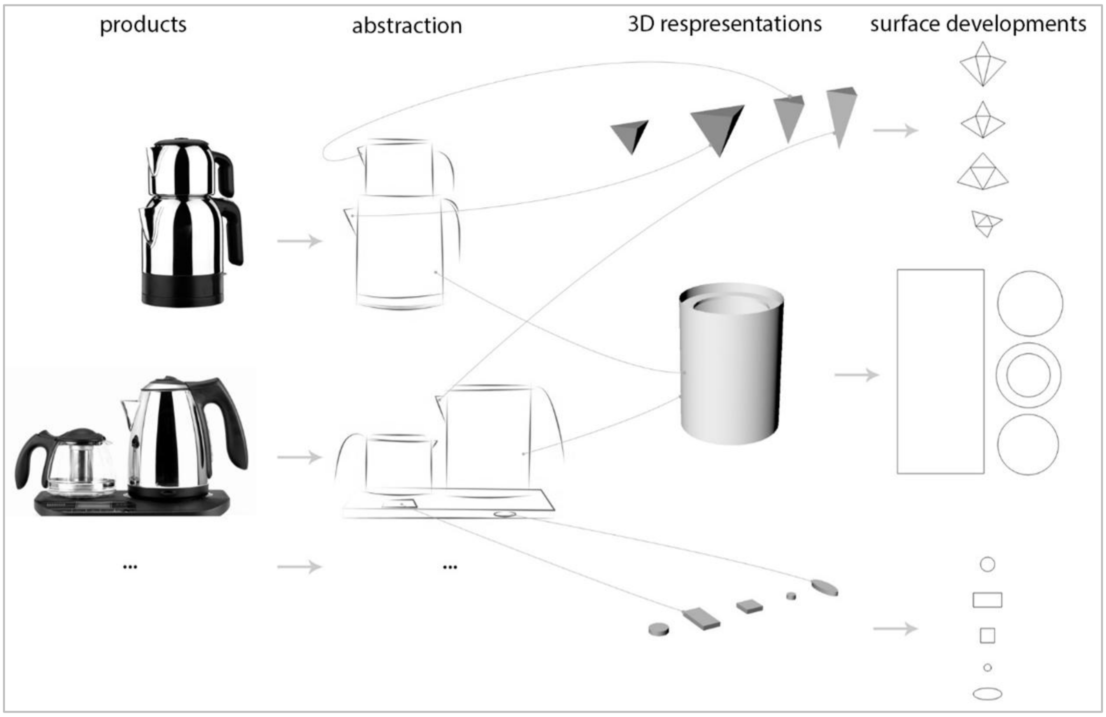


Figure 8.5 Abstraction example of electric tea makers for the toolkit

Diverse and various parts can be added for controls and displays as much as possible. However, the parts are abstract forms so that the preferences of the participant won't be led by the aesthetic features of the parts. In addition to the pre-defined parts, different materials such as play dough, coloured papers and pens, fabric, wire, and so on can be added to the toolkit not only to meet the request of the participants but also to provide them various alternatives for personalisation of their models. Those additional materials can be exchanged between the student teams unless they are used during the ERM sessions. A putty-like adhesive such as Tack-it or Blu-Tack is used to bring together the parts during the 3D modelling phase, however additional materials such as tape can be used where putty-like adhesive is insufficient. The main focus in the toolkit development is to provide diversity to enable the participants to personalize the 3D model based on their preferences.

The toolkit can be prepared by paper-based materials such as corrugated cardboards. Student teams can make the toolkit by hand or by using a laser cutting machine if it is accessible in the faculty workshops (Figure 8.6). To this end, a vectorial drawing file is provided including the surface developments of each part. The file needs be clear enough to help students understand which surface is associated with which part.

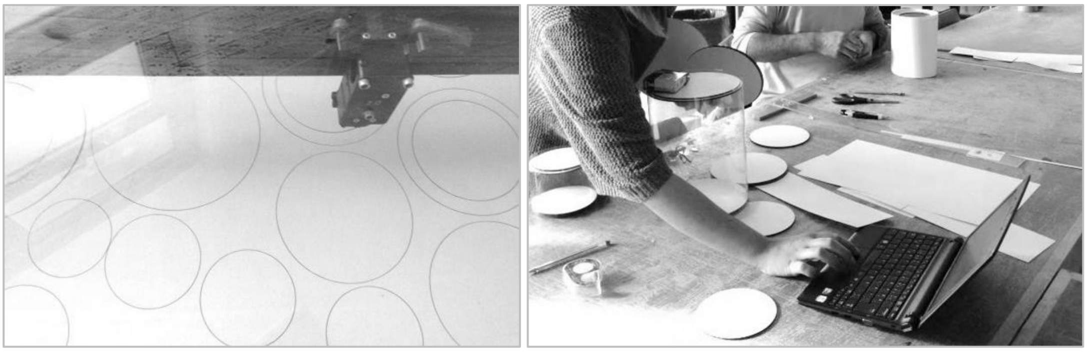


Figure 8.6 Toolkit preparation

Recruitment, and preparing the invitation and the thank you letters. Participants for the ERM sessions should be selected from the actual users. The level of experience of the participant will affect their involvement in the sessions, and the analysis as well. So, the student teams should be encouraged to select experienced users as much as possible. For the recruitment of them, an invitation letter should be prepared giving information about the ERM and the role of participants in the sessions (Appendix Y). It is important in order to inform the participants and enhance their involvement in the sessions. Format of the invitation can be changed such as post card, booklet or letter. After the sessions, a thank you letter or a gift can be given to people for acknowledging their participation (Appendix AA).

Ethical issues and the consent form. Ethical issues should be considered throughout the ERM. A consent form is prepared for taking the permission of the participants before the sessions (Appendix BB). The identity of the participant (i.e. name and face) should not be revealed at the posters or pictures presented at the design studio. The face of the participants can be blurred or filtered by using special graphic tools and effects (e.g. Photoshop, Illustrator, etc.). Since it is difficult to hide the faces by using a simple video editing tool (e.g. Windows Movie Maker), the identity of the participants can be revealed in the video presentations without giving full names. However, it should be ensured that these video presentations would not be published out of academic purposes and without permission.

8.3.2 Suggestions for the ERM Sessions

Planning and conducting rehearsal. For conducting the ERM sessions successfully, the student teams should rehearse the sessions prior to the real ERM sessions (Figure 8.7). Scheduled rehearsals are conducted with the participation of all students in the team. Each student should be aware of her/his responsibility in the session. One student will be responsible for asking the questions, one for helping the participant during the 3D modelling, one for taking pictures, one for tracking the questions from the interview schedule, and one for checking the video recorder. The one who checks the video recorder can be the one who takes pictures, since this doesn’t involve too much work. The participants in the session do not have to be the actual users, and the rehearsals are not expected to last until the sessions are completed, since the aim of rehearsal is to set students familiar with interviewing, 3D modelling and documentation processes in real ERM environment in order to support collaboration in team.

Figure 8.7 A team is rehearsing for the ERM session with the participation of the team member

Setting up the ERM environment and getting ready for the session. The sessions are sequentially scheduled. The duration of the session changes according to the involvement of the participant, but it lasts approximately 60 minutes. The participants are invited to a particular ERM environment set for the sessions. ERM environment can be any kind of room in which a table for three or five can fit and video recorder can be located to capture 3D modelling area. In my experiences, a professional test room which was 18 m^2 was used (Figure 6.16). The main reasons for the participants' attendance in the ERM environment are to reduce the factors affecting their concentration in their domestic environments, and to increase professionalism in the sessions. Moreover, the sessions are conducted in the same ERM environment to provide equal opportunities to the students during the sessions. The difference in the environment may result in difficulties in the documentation. For documentation, there should be at least one video recorder and one camera in the session. The students may bring an additional video recorder, however it is recommended to provide a video recorder for all sessions, and to fix its location in the ERM environment. Battery life of the video recorder may not be enough for all sessions, so it needs to be pluged in.

Before the sessions, you should inform the student about some essential issues:

- The students have to be sure that the batteries of the equipment are full, the memory is sufficient, and the video recorder is on.
- The parts in the ERM toolkit are complete and arranged on the table.
- The thank you letter is ready to give the participant after the session.
- All students in the team are ready before the session to welcome the participant.

Conducting the ERM session. During the sessions, roles of the students should be clear. In the interviewing phase, one student asks questions by using the interview schedule provided, however, other students can also ask questions, if there is something missed in the schedule, or if they wonder about a particular topic that is not included in the interview schedule. Asking the reasons of the participant's responses should not be missed, since these would help the students make better interpretations from the ERM analysis phase. Sequence of the questions may change due to the responses of the participant. One student can track the questions to help the interviewer follow the questions to be asked. The student asking the questions should encourage the participant to use the toolkit while responding the questions. The student helping 3D modelling should not direct the participant while selecting the parts to build up the 3D model. Her/his responsibility is just to help the participant when she/he asks for help. In some cases, the participant may not ask for help, and want to build up the whole model, thus the student may remain inactive during the session.

The student taking the pictures should capture especially the 3D modelling phase. When the participant adds parts to the model and makes changes on the model, the process should be documented for the analysis phase of the ERM.

Archiving the recordings. After the session, the video recordings are achieved in a computer and shared with the student teams, so the teams are advised to bring a memory card sufficient for the size of the video (e.g. the video files in the cases of this thesis were approximately 1 GB). Each recording can be shared just after the session ends, so that the memory of the video recorder will be emptied for the next session, and the team can start to analyse the video right away.

8.3.3 Suggestions for the ERM Analysis

Analysis phase aims to enable students to understand and interpret participants' statements, to reframe interpretations through developing potential design solution areas, and to generate design ideas based on design solution areas. First part of the ERM analysis mainly focuses on comprehension and gaining insights, and developing design solution areas. Second part focuses on developing diverse ideas through compiling research knowledge and tacit knowledge based on design considerations.

Before starting the analysis phase, an additional presentation can be made to remind the students about the ERM analysis. In this presentation, video editing is demonstrated by using a video editing program (e.g. Windows Movie Player, Sony Vegas, etc.). Then, the phases that the student teams will conduct are explained with examples.

8.3.3.1 First Part of the ERM Analysis

Analysing the video. Video analysis requires co-interpretation, thus each member of the teams should involve in the analysis phase. The teams can follow different approaches in analysing the video. For example, they start watching the video all together and stop the video when they find worth exploring and discussing. After they stop the video, they start to discuss about the participant's statements and take notes based on their insights. The notes should include the time slot of the video frame and the related design consideration. This will help the team while editing the video for the presentation. Moreover, a short exercise can be conducted before the analysis with the participation of the whole class about how interpretation can be made.

Gaining insights. Insights which are the interpretation of the participant's statement shouldn't directly refer to product solutions that the participant mentions during the session. It should include cause and effect relationship beyond the participant's statements. For instance, the participant of a team in the third case mentioned that she/he could get bored of the appearance of the tea maker after a while, so handles could be changed without discarding the whole tea maker. If the team interpret these statements as "there should be personalized parts that the user could change anytime, even the handles could be personalized and interchangeable", this insight will directly refer particular parts of the product and the participant's statements. That might limit the students while developing design solution areas and generating design ideas. Instead, the interpretation can be as "personalization of the tea maker or/and the tea making experience is important to create product-user attachment when it becomes outdated aesthetically."

Video presentations. Sharing the outcomes of the first part is essential to enable other teams to benefit from all sessions. That will help them consider diverse user profiles during idea generation phase (Figure 8.8). To this end, student teams present their insights along with a video presentation. The video presentation includes information about the participant (e.g. demographics, the product that she/he uses, experience with the existing product) and video clips that the team find important for the project considerations. The number of video clips can vary between 10 and 15 considering the workload and the duration of the presentation. During the presentation, interpretations of the team can be discussed to enable interaction among the students. For the preparation of video presentations, various mediums can be used based on the developments of the technology in video editing (e.g. Windows Movie Maker, Sony Vegas, VideoNot.es, etc.)

Figure 8.8 A team is presenting their video analysis

Developing design solution areas. After the video presentations, the student teams develop potential design solution areas based on their insights. More than one design solution areas can be developed per one insight. DSAs can also be discussed during the video presentations to encourage the student to start thinking about the further phases of the analysis and to guide them about the development of the DSAs. DSAs should be neither too general nor too specific. For instance, for the insight example given above, the design solution areas can be "evolving tea maker", "personalization of tea experience", "gracefully aging tea maker" rather than "personalization", "evolving", or "long lasting" (too general) or "personalization of handle" or "interchangeable handles" (too specific). A design solution area should enhance the creativity of students instead of leading them to a specific solution.

Submission of insights and DSAs. The insights and DSAs are submitted by using a format provided. In the format, the relationship between the insights and DSAs with the corresponding images from the session should be clear. The insights and DSAs are shared with the studio to enable each student to review them, and to select DSAs for the second part of the analysis. During this sharing, the students can rank their favourite design solution areas by using coloured stickers to make them visible (Figure 8.9).

Figure 8.9 Students are reviewing the submission of insights and DSAs

8.3.3.2 Second Part of the ERM Analysis

Arranging the analysis poster. For the second part of the ERM analysis, the teams decide on the design solution areas for which they want to generate design ideas. The selection can be from other teams DSAs as well. Each student team prepares an analysis poster which brings together their DSAs and design ideas under project considerations (Figure 8.10). Dimension of the posters can be 100 to 140 centimetres. The teams can be inspired by the sample analysis posters provided, however they are allowed to create their own organization on the posters. There are some points to be considered by the students. The DSAs should be categorized under the design considerations and the links between them should be clear. There might be DSAs related with more than one design consideration.

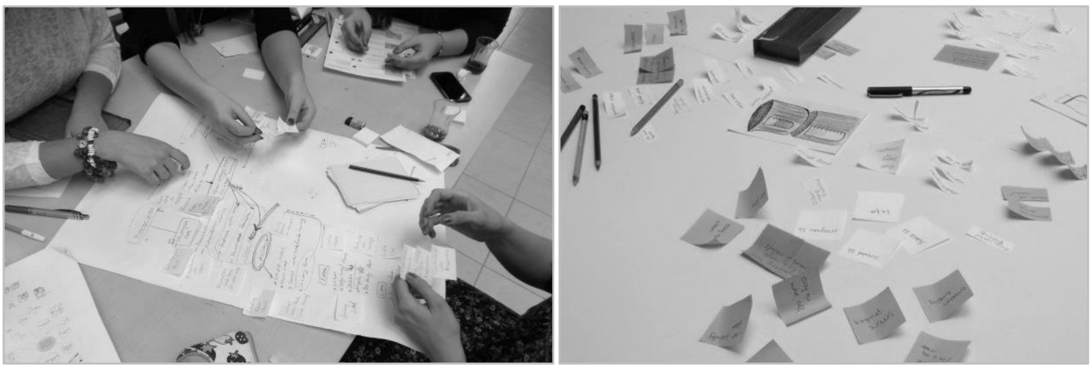


Figure 8.10 Students are arranging the materials for their analysis posters

Developing ideas through sketching. The students make sketches individually through discussing with the team members to reflect their ideas based on the DSAs (Figure 8.11). In this process, they have the opportunity to integrate their design knowledge and skills (i.e. tacit knowledge) into user knowledge. During sketching, the students can use small sheet of papers (e.g. A5, A6, etc.), then they can organize them on the analysis poster. There is no specification in the level of sketches since it's free exploration of the students. The students should be encouraged to generate ideas as many as possible to provide divergence for the further idea generation phases.

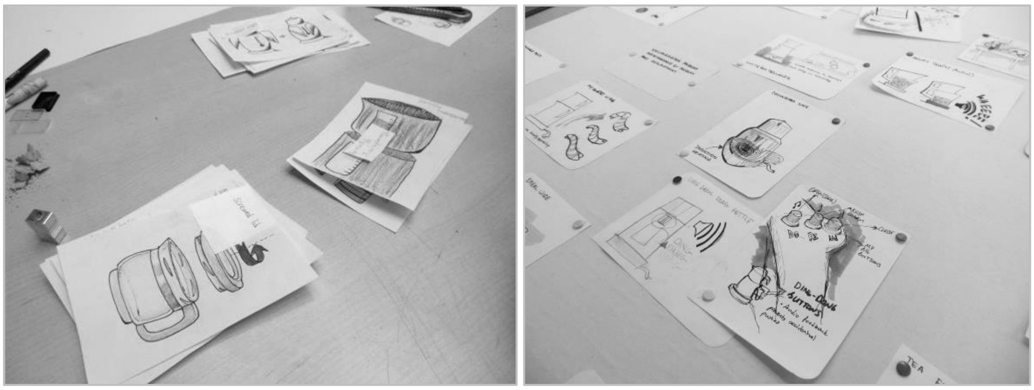


Figure 8.11 Some design ideas sketched on small sheet of papers

Sharing the ERM outcomes. Analysis posters should be shared with the whole studio through presentations to provide a platform for discussion and interaction with other students. At this phase, the teams present the DSAs and ideas that they find original and significant in line with the project considerations (Figure 8.12). After this phase, idea generation phases will start. For the idea generation phase, developing exercises that foster the students to bring forward the outcomes of the ERM are advised. There should be a link between exercises and the ERM analysis to encourage the student to incorporate the outcomes of the ERM into the idea generation phases.

Figure 8.12 Team C in the third case is presenting their analysis poster

8.4 Limitations of the ERM in This Study and Future Adaptations

Design process is nourished by numerous domains such as observing and comprehending, criticizing and analysing, synthesizing through adapting and creating. Design students may not own particular skills and knowledge for these domains, thus it is important to teach these through design education in order to balance the level of knowledge that all students acquire. The purpose of the ERM in design education is to bridge the gap between user research and idea generation phases through

- providing students the skills and techniques used in the ERM to elicit user knowledge,
- enabling them to relate design considerations with user knowledge through interpreting and developing design solution areas,
- and encouraging them to integrate user knowledge into their design knowledge.

The ERM was incorporated into different educational projects in this study; however the projects were product-oriented which expected the students to design particular products (i.e. mini oven, electric tea maker and serving accessories). As a result, some of the questions in the ERM interview schedule were product part-oriented beside experience-oriented, since the sessions proceeded step by step through bringing together the components of the product. For future adaptations in design education, questions in the interview schedule can be more focused on experiences. For instance, for the tea maker case, instead of asking as "How would you prefer handle of the water tank to be?", "How would you hold/grasp/lift it?" can be asked to let the participant select any kind of part or shape from the toolkit. Although asking without referring any product, the participant will also recall her/his experiences with a product while responding. Experience is not independent from artifacts in the use context. Therefore, the participant tends to build up her/his existing product at the beginning of the ERM session. After a while, when she/he is engaged, the participant starts to make changes on the 3D model, and adapts the model based on her/his preferences and needs. 3D modelling in the session is a tool to enable the participant to reveal tacit knowledge that isn't expressed verbally. ERM session aims to gain detailed information about needs and preferences with the participant's experiences, it is not aiming to develop or create an innovative or different object independent from actual experiences. Product focus in the ERM session is usual. For instance, the participant may prefer a particular component for the product in the session (e.g. narrow spout for teapot, plastic handle for water tank, audial feedback indication informing baking process is over in the mini oven). However it becomes problematic if the ERM analysis focuses on the components of a product. In other words, insights and design solution areas should not directly refer a particular part of a product; instead they include the reasons of the preferences and the effects of these on the use experience. Otherwise, conclusions from and insights into the ERM sessions would lead to design students to develop yet another product with incremental changes.

During the session, the participant can deviate from the topic by talking about diverse issues related to use experience. Statements of the participants may not always be related regarding the design consideration in the brief. So, design students should criticize the raw data during analysis. For that, they need to comprehend the design considerations as well as understanding the reasons of preferences. Hence, defining and exemplifying design considerations in the project brief clearly is very important for an effective ERM analysis phase.

The ERM changes the mind-set of design students. They can use the tools and techniques at different stages of design process. For instance, in the second design project of the study, some of the students prepared a 3D mock-up for the user testing phase, and asked the participants to make changes on the 3D model and to express their opinions regarding the design solution. Furthermore, the analysis technique used in the ERM can be incorporated into any kind of design research through further adaptations.

In this study, each student team focused on the whole lifespan of the product based on the sustainable design considerations mentioned in the project brief. In future implications, each student team may focus on a particular period of lifespan of the product or a particular design consideration in the project to gather more intense information from the sessions and to lessen workload. During the analysis phase, the outcomes can be compiled and shared with other students.

The Matrix exercise was incorporated into the design process as the idea generation tool after the ERM in the educational cases. In future adaptations, other idea generation tools can be incorporated into the design process. However, there should be a link between them and the ERM to encourage the students to better use the outcomes of the ERM. Moreover, second part of the ERM analysis can also be developed as an idea generation phase, as it is also a starting point for idea generation through enabling students to develop design ideas based on project considerations.

The participants in the ERM sessions were the ones with whom the design students conducted user observations, since the user observations enabled the participant to be familiar with the project, and increased their involvement in the ERM sessions. Warm-up sessions could be conducted with the participants to replace user observations or in addition to user observations in a way that they would be more connected, informed and prepared for the ERM sessions. To this end, alternative complementary tools and techniques for warm-up sessions can be explored for the further adaptation of the ERM.

In this thesis, the participants of the ERM were the actual users. In future adaptations, other participants or expert users such as service technicians focussing on post-use phase of a product can be involved in the ERM to reveal experiences, needs and preferences about product maintenance and part replacement. The ERM toolkit can be developed based on not only visible components of a product but also technical components such as circuit board, electric parts, motors, resistance, cables, et cetera.

8.5 Importance of the Study

The design research incorporated into this doctoral study is first of its kind in the area in terms of design research and educational perspectives, and sustainability. From design research perpective, this study is an example of the integration of various and diverse approaches through a methodological background to develop and integrate the ERM into design education as a generative research method which enriches students engagement in research and idea generation phases of design process at undergraduate level. The ERM method as the systematic combination of tools and techniques has been firstly incorporated into the educational cases at undergraduate level in the Department of Industrail Design at

METU. It provides an effective design research experience that enriches the interaction between design students and participants, and enables the students to bridge generative research with idea generation phases, since it acknowledges the integration of research knowledge into students' design knowledge through providing various tools and techniques (e.g. 3D modelling in line with design thinking, video analysis, sketching based on design solution areas, etc.).

The tools used in the ERM method (i.e. interview schedule, analysis formats) were developed based on the sustainability considerations that were integrated into the design projects. If the project has a main emphasis on sustainability, these tools can be developed based on sustainability considerations. By this way, students have the chance to develop design solution areas and design ideas based on these. The incorporation of the ERM into design for sustainability projects in design education has the potential to increase the acceptability of sustainable solutions by a bottomup approach through getting people involved and incorpoting local knowledge in design process.

Furthermore, this study involves comprehensive field studies adopting an educational perspective which aims to explore the relationship between the ERM and student engagement. Throughout the doctoral study, the researcher has been involved in the educational process, and gained insights of the design students about the ERM. The ERM has been developed considering student engagement through a student-centered approach, since the participation and engagement of the students is important for a constructivist educational environment to provide them with competences involving skills and knowledge for design thinking. This thesis also provides guidelines considering student engagement for the readers who wish to implement the ERM into other design projects.

8.6 Recommendations for Further Research

It is worth investigating the implementation of the ERM for an experience oriented project (e.g. developing tea brewing and serving experience rather than electrical tea maker, or developing baking experience rather than mini oven). Then, development of the interview schedule and the toolkit will be different, since those are developed based on the project brief and considerations.

The development of the ERM folder (i.e. brief, presentation, interview schedule, toolkit, invitation letter, consent form) needs time and expertise. For delivering the knowledge for this expertise, different mediums can be explored. Workshops with design educators can be conducted. Additionally, ERM files can be shared via internet to help the educators be inspired from existing materials and implementations, and to provide a platform for the spread of knowledge and experiences about the ERM. By these ways, the tools and techniques used in the ERM can be further developed and adapted with the involvement of different participants such as design educators, design researchers and students, and even design professionals.

In this study, the ERM was incorporated into undergraduate level, and the tutors were responsible for the development of the ERM phases. It is worth exploring the implementations for graduate design students and professional designers, and leaving the responsibility to them. To investigate their approaches to the ERM might be inspiring for the further development of the ERM. Graduate students can adapt the ERM for their graduate studies, and professionals can adapt the phases of the ERM based on the projects and the time plan.

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APPENDIX A

THE STUDIO TEAMS AND THE DESIGN STUDENTS INVOLVED IN THE THESIS

Name of the project	Studio Team	Students
Transcending Products: Glass Packaging with Double Life (2010 Fall)	Çağla Doğan, Fatma Korkut, Aykut Coşkun, Sedef Süner, Senem Turhan	Bahaeddin Önal, Buse Üstün, Cansu Peköz, Deniz Şenyurt, Didem Yanpar, Dilcu Keleş, Ece Güçlü, Eren Şenyurt, Evgenıa Ponomareva, Fatma Akçay, Gamze İskender, Gizem Cürdaneli, Gizem Harut, Gökçe Altun, Göktuğ Duman, Güzin Şen, Halit Sancar, Hande Asıcı, Hilal Coşkun, Itır Güngör, İrem Özdemir, Koray Benli, Mehmet Demirezen, Mert Kaygısız, Mert Kulaksız, Merve Özdemir, Nagehan Tuna, Özgür Kızıl, Pınar Şimşek, Reyhan Topsakal, Serdar Arıçelik, Sıla Karagöl, Şirin Cincioğlu, Tım Denshıre-Key, Tuğçe Çavuşoğlu, Yasemin Dönmez, Yasemin Efe, Zeynelabedin Azırı
My Sustainable Mini Oven (2011 Spring)	Çağla Doğan, Fatma Korkut, Selim Gençoğlu, Aykut Coşkun, Sedef Süner, Senem Turhan	**Team A** - Fatma Akçay, Tuğçe Çavuşoğlu, Dilcu Keleş, Merve Özdemir, Halit Sancar **Team B** - Bahaddin Önal, Güzin Şen, Itır Güngör, Koray Benli, Mert Kaygısız, Yasemin Camadan **Team C** - Eren Şenyurt, Gökçe Altun, İrem Özdemir, Reyhan Topsakal, Hilal Coşkun **Team D** - Hande Asıcı, Şirin Cincioğlu, Evgenia Ponomareva, Caner Çiftçi, Z.Didem Yanpar **Team E** - Buse Üstün, Mehmet Demirezen, Yasemin Dönmez, Zeynelabidin Aziri
Making Tea as an Engaging Practice: Electrical Tea Maker with its Serving Set (2012 Spring)	Çağla Doğan, Fatma Korkut, Selim Gençoğlu, Mustafa Hasdoğan, Sedef Süner, Senem Turhan	**Team A** - Evgenia Ponomareva, Ezgi Kış, Ezgi Özdemir, Gizem Görçin, Ilgar Akbarov **Team B** - Adem Önalan, Ahmet Burak Aktaş, Burak Söylemez, Fulden Dehneli, Hafize Beysimoğlu, Merthan Öztürk **Team C** - Ayşe Ayça Vanlı, Didem Er, Heja Can Deniz, İrem Arı, Seda Aksoy, Sinem Öz **Team D** - Cemal Çağlar Bektaş, Deniz Gülmezoğlu, Ece Akevren, İsmail Malçok, Mahmut Demirok **Team E** - Derya Adıyaman, Ezgi Çetin, İlkin Taşdelen, Medina Bekteşeviç, Meriç Dağli, Serdar Arıçelik **Team F** - Kaan Karaca, Nurten Selin Özden, Oliver Whittaker, Oya Deniz Senyurt, Rachelle Dunstan
Engaging and Sustainable Design Solutions for Tea Making and Serving Experience (2013 Spring)	Çağla Doğan, Fatma Korkut, Mustafa Hasdoğan, Harun Kaygan, Koray Benli, M. Erdi Özgürlük, Sedef Süner, Senem Turhan	**Team A** - Çiğdem Demir, Duygu Güroğlu, Hatice İçer, Mehmet Berberoğlu, T. Öykü Polat **Team B** - Ahmet Oğuz, Berk Saraloğlu Ryan Fickenscher, Ucal Abbaslı, Yasemin Akbaba **Team C** - Alev Sönmez, Aybars Şenyıldız, Cem Mehmethanoğlu, Duygu Bostancı, J. Selin Sarıfakıoğlu **Team D** - Levent Muslular, Mohammadamin Amanpour, Receb Bilici, Sema Kiraz Turhan, Tolga Tuncer **Team E** - Arif Madanoğlu, Ayşegül Uzunyol, Burak Bozok, Onurcan Önal, Pelin Aslan **Team F** - Hazal Alkan, Gülesin Özkoç, Burcu Uçan, Zeynep S. Demircioğlu

APPENDIX B

PROJECT BRIEF OF TRANSCENDING PRODUCTS: GLASS PACKAGING WITH DOUBLE LIFE

Middle East Technical University Faculty of Architecture Department of Industrial Design

Fall 2010-11 ID 301 Industrial Design III

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Res. Asst. Aykut Coşkun, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

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

Transcending Products: Glass Packaging with Double Life in Collaboration with Anadolu Cam

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
- Designing for corporate identity

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 the 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 glass packaging designs will be developed for A.O.Ç. (Atatürk Orman Çiftliği) branded products in particular.

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 and A.O.Ç.'s sustainable glass packaging alliance for social responsibility, environmental stewardship and economic viability.

Use phase

The glass packaging designs will be developed for the following products of A.O.Ç.

- **Milk products:** Milk, ayran, yoghurt
- **Others:** Fruit juice, vinegar, wine, pomegranate sauce, honey, pickles

Post-use phase

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

- Bathroom accessories (liquid soap dispenser, tooth brush holder, bathroom tumbler, tissue holder)
- Water bottle and accessories
- Candle jars

The stages of the project

Part 1 – Literature Search, Field Observations and Project Dimensions

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

Part 2 – Initial Design Exploration

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 post-use products.

Part 3 – Concept Development and User Testing

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

Output: Alternative design solutions, appearance model, and user testing results.

Part 4 – Final Design

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

Grading:
Attendance and participation in class exercises 10%
Preliminary Jury 30%
User testing results, and design details and sections 10%
Final presentation and deliverables 50%

APPENDIX C

INTERVIEWING AND SURVEY QUESTIONS FOR THE PRELIMINARY STUDY

Interviewing Questions

Katılımcı Adı ve/veya Numarası:

Tarih:

Ses Kayıt No:

1. Projenin başında kullanıcı gözlemleri sırasında topladığınız bu *post-use* örneklerinden hangisini veya hangilerini ilham verici buldun? Neden, açıklar mısın?

2. Peki, bireysel ve grup olarak hazırladığın matrix örneklerine tek tek bakarak fikrin çıkma sürecini kısaca anlatmanı isteyeceğim.

- nasıl ortaya çıktı
- ne aşamayla çıktı (hangi aşamada çıktı)
- nelerden etkilendin

3. Bu projede yaptığınız kullanıcı gözlemlerinin projene etkisi olup olmadığı konusunda ne düşünorsun? (yanıtı evet ise) Ne derecede etkili açıklar mısın?

Name of the Participant or/and Number:

Date:

Voice recording number:

1. Which post-use examples did you find most inspiring that you gathered from the user observations at the beginning of the project? Could you please explain, Why?

2. Could you please explain the idea generation process through the matrix exercise that you conducted individually and as a team.

- how did the idea come out
- in which phase
- your inspirations

3. To what extent did the user observations affect your project?

Survey Questions

Name:

1. To what extent did you benefit from the outcomes of user observations (at the beginning of the project) for the idea generation phase (i.e. matrix I, matrix II.)?
2. Could you explain this by giving example(s) from your design ideas that you developed through the Matrix exercises? Please insert the design idea(s) that are inspired from the initial user observations.

APPENDIX D

PROJECT BRIEF OF MY SUSTAINABLE MINI OVEN

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2010-11 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Selim Gençoğlu, Res. Asst. Aykut Coşkun, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

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Project II–Rethinking and Re-contextualizing Mini Oven with Serving Units in Relation to Sustainable Design Considerations

"My Sustainable Mini Oven" in Collaboration with Profilo

The current mini oven designs need to be reevaluated and revisited in accordance with sustainable design considerations. In comparison to conventional large ovens, mini ovens are economic and practical alternatives for most low-middle income households in Turkey. This project aims to develop design solutions for mini ovens and further emphasizes its economic and practical aspects by incorporating sustainable design considerations.

Target User Group and Objective

- *Target user group:* The main target group of this project is local users and households with low-middle income level. In addition to typical mini oven users (i.e. housewives), other potential mini oven users will also be taken into consideration such as households with small children, student and bachelor households, working single parents, elderly people living alone, etc.
- *Objective:* The main objective of the project is to rethink and re-contextualize the mini oven considering its whole product lifespan for both use and post-use phases with a particular focus on maintenance and repair, engaging design solutions and energy efficiency.

Sustainable Design Considerations

Developing design solutions which consider the whole lifespan of a product including both the use and post-use phases (i.e. repair, reuse and recovery) is a critical sustainable design consideration, specifically for household goods and appliances with innovative product-service systems solutions. This project will focus on the following three dimensions in particular, which emphasize both technical and socio-cultural aspects of the product lifespan:

- **Product maintenance and repair:** Maintenance and product part replacement are among the sustainable design considerations to prolong product lifespan. In this project, this consideration includes ease of maintenance and cleaning, as well as refurbishing, replacing or renewing outdated or worn-out parts technically or aesthetically (e.g. adding new functions or offering optional design features such as color and graphic applications).

- **Engaging design solutions:** Design solutions taking into consideration the local culture and rituals (i.e. cooking, baking, serving, hosting, and local cuisine) enrich user experience and product user interaction, promote product value, meaning and longevity, and encourage product personalization (e.g. personal cooking habits and styles resulting from past experiences).

- **Energy efficiency and consumption:** Raising awareness about energy efficiency and consumption along with communicating the use of energy in household appliances are important design considerations to create more sustainable solutions and to promote changes in user behavior in line with responsible consumption patterns. Therefore, the design solutions, in this particular project, should be informed by user behavior and usage patterns (e.g. using an oven next to a refrigerator, pre-heating or cooling off a mini oven) which affect energy efficiency and consumption.

Project Phases

- **Literature search and user observation:** Prior to idea generation phase, one of the main stages of this project is literature search which will be conducted in teams. The literature search includes a review and analysis of various topics related to the project context. User observation phase covers user visits, interviews and observations, and will be conducted in private homes, dormitories and offices to observe and record the use, maintenance and storage of mini ovens from diverse brands to identify problems and gain insights into the usage patterns. Based on the results of the literature search and user observation, the student teams will suggest insights, findings and project dimensions.
- **Experience reflection modeling (ERM) sessions:** Next, the student teams will conduct exploratory ERM sessions with the participants they met during the user observation phase. The ERM will be used as an exploratory tool which helps users express and externalize their experiences related to the whole life span of a mini oven. The analysis of ERM sessions will lead to emerging themes and potential solution areas.
- **Review of initial ideas and preliminary evaluation (individual):** Each student will present two alternative design solutions to focus on. The evaluation of individual sketchbooks will be an important part of this phase.
- **Design detailing and final evaluation:** The students will finalize the design solution in detail, and prepare the final presentation for evaluation. The final presentation will include the sketchbook, 2D boards and a 3D full-scale white model reflecting the important product features.

Grading:

Literature search and user observation: % 10

Experience reflection modeling (ERM): % 15

Preliminary Jury: % 25

Final Jury: % 50

APPENDIX E

THE ERM BRIEF FOR THE MY SUSTAINABLE MINI OVEN PROJECT

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2010-2011 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Selim Gençoğlu, Res. Asst. Aykut Coşkun, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

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Project II–Rethinking and Re-contextualizing Mini Oven with Serving Units in Relation to Sustainable Design Considerations

"My Sustainable Mini Oven" in Collaboration with Profilo

Design Research: Experience Reflection Modeling (ERM)

Digital submission and presentation: 25 April 2011, Monday 13:40

The aim of this phase is to conduct exploratory Experience Reflection Modeling (ERM) (known as "Velcro modeling" in the literature) sessions with the participants that the student teams met during the user observation phase. ERM will be used as a generative method which helps users recall and express their experiences and preferences related to the whole life span of a mini oven (i.e. defrosting/baking/roasting/grilling, serving, care and cleaning, storing, repairing, upgrading, etc.).

During the session the student researcher asks questions to the participant about her/his mini oven experiences and preferences by using the ERM schedule provided. In response to that the participant expresses her/his thoughts (i.e. she/he "thinks aloud") as she/he brings together the components of a mini oven by using the tool kit provided.

Phases of ERM

The ERM method involves the following phases:

- Prepare a tool-kit
- Recruit the participants and arrange the appointments
- Review and rehearse the ERM schedule provided
- Set-up the research environment (a silent, well-ventilated and well-lighted room, a bottle of drinking water, notebook and sketchbook, colored pens and pencils, a table, chairs, the tool kit and the recording devices -a video cam and a photographic camera)

- Conduct the ERM session by using the ERM schedule provided
- Analyze the ERM session and report the findings/conclusions/insights by using the format provided

ERM Toolkit

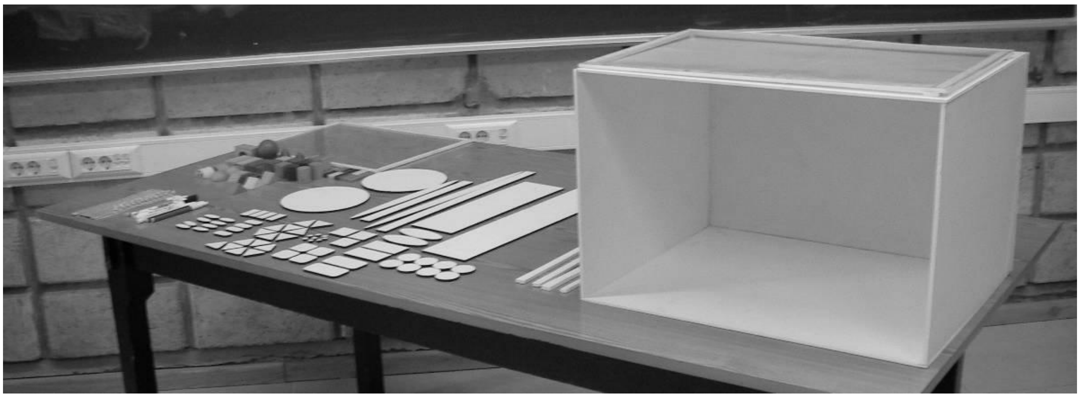

Figure E.1 Sample ERM toolkit

The ERM toolkit includes simple 2D shapes and 3D forms representing various potential components of a mini oven such as main body, glass door, handle, trays, shelves/racks, controls and displays (e.g. timer, indicator lights, switches, hotplate controls, etc.), hotplates, cable, feet, etc.

Suggested materials for the toolkit are corrugated cardboard, paperboard, foam-board, acrylic, acetate, plywood, Styrofoam, etc. You may use various materials, but we recommend that you choose materials appropriate for the laser-cutting machine in our workshops.

In order to tailor the model to the specific requests or needs of the participants you may also use colored pens and pencils, paper tape, string, wire, play-dough, various types of papers, fabrics, etc.

Analysis of ERM Sessions

The student teams analyze the video recordings as follows:

- Choose 10 snapshots from the video stream
- Present them together with verbatim transcriptions of participants' comments and descriptions
- These user descriptions and comments will help us identify and highlight interesting and insightful aspects of the ERM session.

To present the results of your analysis use the format provided.

APPENDIX F

THE ERM INTERVIEW SCHEDULE FOR THE MY SUSTAINABLE MINI OVEN PROJECT

F.1 TURKISH

Orta Doğu Teknik Üniversitesi Endüstri Ürünleri Tasarımı Bölümü
Bahar 2010-2011 ID 302 Endüstri Ürünleri Tasarımı IV

Yrd. Doç. Dr. Çağla Doğan, Yrd. Doç. Dr. Fatma Korkut, Yarı-zamanlı Öğr. Gör. Selim Gençoğlu, Araş. Gör. Aykut Coşkun, Araş. Gör. Sedef Süner, Araş. Gör. Senem Turhan

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ODTÜ-Profilo Sürdürülebilir Mini Fırın Tasarımı Eğitim Projesi

ERM (*Experience Reflection Modeling)* Kılavuzu

Mini Fırın Görüşme Kılavuzu

1. Giriş

Görüşmemize başlamadan önce size yaptığımız araştırmayla ilgili biraz bilgi vermek istiyoruz. Bizler ODTÜ Endüstri Ürünleri Tasarımı Bölümünde üçüncü sınıf öğrencisiyiz. Benim adım .... görüşmeye katılan diğer arkadaşlarım da .... ve .... Bu araştırmayı tasarım dersi kapsamında sizin mini fırına yönelik görüşlerinizi öğrenmek için yapıyoruz. Bu görüşmede toplanan veriler eğitim amaçlı olarak tasarım sürecinde, tez araştırmalarında, bilimsel yayınlarda ve sunuşlarda kullanılacak. Görüşme sırasında anlattıklarınızı yalnızca bilimsel amaçlarla kullanacağız. Kimliğinizle ilgili bilgileri saklı tutacağız. Konuştuklarımızı daha sonra tam olarak hatırlayabilmek ve gözden geçirebilmek için görüşmemizi kaydedeceğiz. Görüşmemiz bir saat kadar zaman alabilir.

Görüşmeye başlamadan önce sormak istediğiniz herhangi bir şey var mı?

2. ERM sürecine yönelik katılımcıyı bilgilendirme

Şimdi kısaca birlikte neler yapacağımızdan bahsetmek istiyoruz. Gördüğünüz gibi elimizde bir takım şekiller var. Bu şekillerle bir mini fırın oluşturacağız. Mini fırını oluştururken ayrıntıları hatırlamanızı kolaylaştırmak için bir pişirme sürecini yaşıyormuş gibi yapacağız.

Mini fırını oluştururken doğrudan bu şekilleri kullanabileceğiniz gibi isterseniz kalem ve makas yardımı ile bu şekiller üzerinde değişiklikler de yapabilirsiniz. Bu şekiller dışında başka bir şekil de önerebilirsiniz. Önerdiğiniz bu farklı şekilleri oyun hamuru ile oluşturabiliriz. Bu süreç boyunca istediğiniz zaman biz de size yardımcı olabiliriz.

Mini fırının parçalarını bir araya getirirken <u>sizin</u> tercih ve önerilerinizi anlamak istiyoruz. Bu nedenle aklınızdan geçenleri yüksek sesle söylemeniz sizi daha iyi anlamamıza yardımcı olacak. Oluşturduğunuz mini fırında herhangi bir aşamada değiştirmek istediğiniz şeyler olursa değiştirebilirsiniz ya da bizden değiştirmemizi isteyebilirsiniz.

Başlamadan önce sürece yönelik sormak istediğiniz herhangi bir şey var mı?

3. ERM süreci

Araştırmacıya notlar
ERM sürecinde dikkat edilmesi gereken noktalar: ERM, kullanıcıların belli bir ürün ile ilgili yaşadıkları deneyimleri, görüşlerini ve tercihlerini ifade etmeleri için kurgulanmış özel bir yöntemdir. Kullanıcılar bir yandan araştırmacının yönelttiği soruları yanıtlarken bir yandan da kendilerine sağlanan setin elemanlarını kullanarak söz konusu ürünün üç boyutlu fiziksel bir modelini oluştururlar. Bu fiziksel model, kullanıcının ürünle ilgili deneyimlerini hatırlamasına ve tercihlerini somut olarak ifade etmesine yardımcı olur. ERM süreci, araştırmacının sorularına verilen yanıtlarla ve mini fırının katılımcı tarafından basamak basamak oluşturulmasıyla ilerler. Katılımcının mini fırını oluştururken sürece aktif katılımı esastır. Katılımcının yaptığı tercihlerin nedenlerinin öğrenilmesi önemlidir. Bu kılavuz metninde * ile işaretlenmiş sorularda araştırmacı, setin parçalarını ve oluşturulan modeli kullanması için katılımcıyı özendirmeli; ayrıca katılımcının yanıtlarından veya yaptığı tercihlerden sonra katılımcıya “Neden bunu tercih ettiniz?” “Başka bir şey tercih eder misiniz?”gibi sorular yöneltmeli ve <u>tercihlerinin</u> <u>nedenlerini</u> öğrenmelidir. Parçaların seçimi, yerleştirilmesi ve gerekirse parçalar veya model üzerinde değişiklikler yapılması konusunda araştırmacı, eğer isterse katılımcıya yardımcı olabilir. ERM sürecinde bir kişinin video çekimiyle ilgilenmesi, bir kişinin katılımcıya soruları yöneltmesi, bir kişinin de üç boyutlu modelleme sürecinde gerekli durumlarda katılımcıya destek olması önerilir.

3.1 Diyelim ki mini fırınınızda bir şey pişirmeye karar verdiniz. Ne pişirmek istersiniz?

> (Eğer katılımcı ne pişireceğine karar veremiyorsa, bir önceki kullanıcı gözleminde edinilen bilgilerden yararlanarak araştırmacı bir öneri getirebilir.)
>
> Mini fırını en fazla (............) yaparken kullanıyorum demiştiniz. İsterseniz (............) pişirelim/yapalım.

3.2 Pişirmeye başlamadan önce ne gibi hazırlıklar yaparsınız?

> Mini fırını nasıl hazırlarsınız?
>
> Mini fırını pirize yakın bir yere götürür müsünüz?
>
> *Lütfen kabloyu gövdeye yerleştirir misiniz?
>
> Pişirme yaparken birden fazla tepsi veya pişirme kabı kullandığınız oluyor mu? Neden? (Katılımcının yanıtı ve tercihine göre belli sayıda tepsi kullanarak görüşmeye devam edilir.)
>
> Pişirmeden önce ön ısıtma yapıyor musunuz?

3.3 Diyelim ki (............) hazırladınız. Bu tepsinin içinde (veya ızgaranın üzerinde) (............) var.

*Tepsiyi veya ızgarayı mini fırının içine nasıl yerleştirirsiniz?

*Farklı bir yerleşim tercih eder miydiniz? Neden?

3.4 *Mini fırının kapağını nasıl kapatırsınız?

*Farklı bir açma şekli tercih eder miydiniz? Neden?

3.5 Mini fırınınızı (............) pişirmek için nasıl ayarlarsınız?

*Pişirme sürecinde ne gibi ayarlar yaparsınız?

Isı ayarı yapar mısınız?

Program ayarı yapar mısınız?

Zaman ayarı yapar mısınız?

*Mini fırına ayarlarla ilgili eklemek istediğiniz özellikler var mı? Neden?

3.6 (............) yerleştirdiniz, kapağı kapattınız ve mini fırınınızı ayarladınız. Mini fırının çalıştığından nasıl emin olursunuz?

*Çalıştığından emin olmak için farklı bir şey tercih eder miydiniz? Neden?

3.7 (............) şu anda pişiyor. Pişirme sırasında (............) ne sıklıkta, nasıl kontrol edersiniz?

(Kontrol işlemini özellikle mini fırının kapağını açıp yapıyorsa) Başka bir şekilde kontrol etmeyi tercih eder miydiniz? Neden?

(............) piştiğini nasıl anlarsınız?

3.8 Kullandığınız diğer ürünlerle karşılaştırdığınızda mini fırınınızın enerji tüketimi nasıl?

Mini fırınınızı kullanırken -pişirme öncesinde, pişirme sırasında veya pişirdikten sonra- enerji tüketimini azaltmak için kullandığınız yöntemler var mı?

Kullanım sırasında enerji tüketimini azaltmak için dikkat ettiğiniz şeyler var mı?

*Sizce enerji tüketimini azaltmak için mini fırına ne gibi özellikler eklenebilir?

3.9 *(............) pişirme sürecine geri dönersek, diyelim ki (............) pişti, pişirme sürecinin sonunda neler yaparsınız?

*Mini fırını ne zaman kapatırsınız, fişini çeker misiniz? Neden?

*Mini fırını nasıl soğutursunuz?

*(............) mini fırından ne zaman çıkarırsınız? Nereye koyarsınız? Neden?

Mini fırınınızı kullanırken pişirme ile ilgili bir sorun yaşadınız mı? (Örneğin, pişmemesi, yanması, kabarmaması, altının veya üstünün farklı pişmesi...)

*Sizce pişirme süreci açısından mini fırına ne gibi özellikler eklenebilir?

3.10 *Pişen (............) servisini nasıl yaparsınız?

Mini fırında pişirdiğiniz çeşitli şeylerin servisini nasıl yaparsınız?

Servis yaparken mini fırının tepsisini kullanır mısınız? Neden?

Servis yaparken başka ne tür ürünler ya da aksesuarlar kullanırsınız? Neden?

*Sizce servis açısından mini fırına ne gibi özellikler eklenebilir?

3.11 *Mini fırınınızın temizliğini nasıl yaparsınız?

Mini fırınınızın içini nasıl temizlersiniz?

Mini fırınınızın dışını ve kapağını nasıl temizlersiniz?

Temizlerken ne gibi zorluklarla karşılaşıyorsunuz?

*Sizce temizlik açısından mini fırına ne gibi özellikler eklenebilir?

3.12 Daha önce mini fırınınız bozuldu mu veya hiç servise götürdünüz mü? Neden?

Mini fırınınızın bozulmaması için kullanırken özellikle dikkat ettiğiniz şeyler var mı? Neden?

Sizce mini fırın için tamir veya servis önemli mi? Neden?

Mini fırınınızla ilgili bir kaza yaşadınız mı?

*Bir kaza yaşanmaması için mini fırına ne gibi özellikler eklenebilir?

3.13 Diyelim ki bu mini fırını uzun süredir kullanıyorsunuz ve artık eskidiğini düşünüyorsunuz. Mini fırınınızı elden çıkarmadan yenileme şansınız olsaydı, hangi parçalarını yenilemek isterdiniz?

(Katılımcı yanıt vermekte zorlanırsa) Örneğin gövdesi, kordonu, ayakları, kapağı, kulbu, iç hacmi, tepsileri veya aksesuarları, ayar düğmeleri ve özellikleri...

Neden?

3.14 *Bu mini fırına yeni bazı özellikler ekleseydiniz, neler eklemek isterdiniz?

*Bu mini fırında bazı iyileştirmeler yapsaydınız neler yapardınız?

(Katılımcının bu soruyu yanıtlarken biraz zamana ihtiyacı olabilir. Katılımcının ERM sürecinde mini fırına eklediği özellikler araştırmacı tarafından tekrarlanır ve katılımcıya başka eklemek istediği bir şey olup olmadığı bir kaç kez sorulur.)

3.15 Mini fırınla ilgili üzerinde yeterince konuşmadığımız veya eklemek istediğiniz her hangi bir şey var mı?

4. ERM sürecinin değerlendirilmesi

4.1 Mini fırını oluşturma sürecimiz burada bitti. Bu sürecin geliştirilmesi ve iyileştirilmesi için önerileriniz var mı?

Mini fırını oluştururken zorlandığınız şeyler oldu mu?

Sunulan şekil ve malzemeler konusunda önerileriniz var mı? Başka neler eklenebilir?

Mini fırın için kullandığımız bu hacim yeterli miydi? Daha farklı bir hacim veya şekil tercih eder miydiniz?

Süreci sizin açınızdan kolaylaştırmak için başka neler yapabiliriz?

Çalışmamıza gerçekten önemli bir katkıda bulundunuz. Katıldığınız için çok teşekkür ederiz.

ODTÜ-Profilo Sürdürülebilir Mini Fırın Tasarımı Eğitim Projesi ERM Süreci

Katılımcı Bilgileri

Görüşmeyi yapan araştırmacılar	
Görüşme tarihi	
Görüşme yeri	
Toplam görüşme süresi	
Katılımcının adı, soyadı	
Cinsiyeti	
Yaşı	
Eğitim düzeyi	
Mesleği ve işi	
Kullandığı mini fırının markası	
Mini fırınını kaç yıldır kullandığı	
Katılımcının sahip olduğu mini fırının fotoğrafı	
Katılımcının ERM sürecinde oluşturduğu mini fırının fotoğrafları	

APPENDIX G

MAKING TEA AN ENGAGING PRACTICE PROJECT BRIEF

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2011-12 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Selim Gençoğlu, Part-time Inst. Mustafa Hasdoğan, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

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Term Project

Making Tea as an Engaging Practice: Electrical Tea Maker with its Serving Set in Collaboration with Esse

Tea making is a natural part of our daily life. We have tea at breakfast, after lunch and dinner, or when we give a break or start a challenging task. Tea motivates us, helps us socialize, engage or concentrate. Tea is what we offer to our guests at home or at work; it is the social glue in Turkish society.

Electrical tea makers have been becoming effective and more preferable alternatives to conventional teapots used in households in Turkey. The current electrical tea maker designs along with its serving accessories (e.g. tea glass and saucer, tea spoon, sugar bowl, tea cup or mug, tray, etc.) need to be re-evaluated and revisited in accordance with sustainable design considerations. The main target user group and environment of this project is local users and households. In addition to typical users, other potential users and environments may also be taken into consideration such as students in dormitories or workers in small workplaces.

Sustainable design considerations for developing engaging design solutions

The main goal of this project is to reconsider making and serving tea, and to develop engaging design solutions which reinforce local values, encourage maintenance and repair, and raise awareness about consumption of resources.

Incorporating local values, usage patterns and rituals: Design solutions informed and inspired by the local values, conventions, rituals, habits and usage patterns related to tea making and serving enrich user experience and product-user interaction, and encourage personalization. These local values and needs manifest themselves at various phases of use (e.g. preparing, brewing and serving the tea; cleaning the tea maker, the tools and the accessories, etc.).

Encouraging product maintenance and product part replacement: Ease of maintenance and cleaning, replacing or renewing outdated or worn-out parts technically and/or aesthetically empower users, support product engagement and prolong product life span.

Understanding resource consumption patterns and communicating the process of tea making: Understanding resource consumption patterns, raising awareness about water and energy efficiency, making the use and consumption of resources visible, and communicating the various phases of tea making process promote engaging and affordable design solutions, and encourage changes in user behavior in line with responsible consumption patterns.

Project Phases

Literature search and user observation (team): Prior to idea generation phase, one of the main stages of this project is literature search and user observation which will be conducted in teams. The literature search includes a review and analysis of various topics related to the project context. User observation phase covers user visits, interviews and observations, and will be conducted in private homes, dormitories or small workplaces to observe and record the use, maintenance and storage of tea makers and related accessories from diverse brands to identify problems and gain insights into the usage patterns. Based on the results of the literature search and user observations, the student teams will present insights, findings and project dimensions.

Experience Reflection Modeling (ERM) sessions (team): The student teams will conduct exploratory ERM sessions with the participants the teams met during the user observation phase. The ERM will be used as an exploratory tool which helps users express and externalize their experiences related to the tea making and the whole life span of a tea maker. The analysis of ERM sessions will lead to emerging themes and potential solution areas.

Disassembly and re-assembly session: A tea maker will be disassembled, all the inner parts will be identified, working principles and details will be explained, and frequent user complaints and product failures will be discussed. The process will be facilitated by an experienced service technician from Esse.

Initial design exploration (team and individual): The students will develop initial ideas through the MATRIX and Task exercises to explore diverse design solutions.

Review of initial ideas (individual): Each student will present alternative design solutions.

User testing and preliminary evaluation: The students will focus on a design solution, conduct user testing and present it together with a full scale mock-up.

Final evaluation: The students will finalize the design solution in detail, and prepare the final presentation for evaluation. The final presentation will include 2D presentation boards and a 3D full-scale white model reflecting the important product features

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APPENDIX H

THE ERM BRIEF FOR MAKING TEA AN ENGAGING PRACTICE PROJECT

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2011-12 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Selim Gençoğlu,

Part-time Inst. Mustafa Hasdoğan, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

Term Project: Making Tea as an Engaging Practice - Electrical Tea Maker with its Serving Set in Collaboration with Esse

Experience Reflection Modeling (ERM)

ERM sessions: 15-16 March 2012

Analysis Part I: 20 March, Tuesday 13:40

Analysis Part II: 23 March, Friday 8:40

Presentation: 23 March, Friday 13:40

1. Introduction

The aim of this exercise is to conduct exploratory and generative Experience Reflection Modeling (ERM) sessions with the participants that teams met during the user observation phase. The ERM method will be used as a generative design research method which helps participants reflect on their needs, experiences, preferences and expectations regarding an electrical tea maker and its serving set. The ERM sessions will help you understand how to incorporate local values, what the usage patterns and rituals are, how to encourage product maintenance and product part replacement, what the resource consumption patterns are, and how to communicate the process of tea making.

As a method the ERM brings together 3D modeling, interview and video recording techniques. In an ERM session the researcher asks questions to the participant by using an interview schedule, and in response to that the participant expresses her/his thoughts aloud, and builds a 3D model of a particular product by using a toolkit provided.

This exercise will consist of the following phases:

- Introduction and presentation of the ERM method by the tutors
- Preparing the ERM toolkit
- Arranging the participants
- Getting familiar with the questions in the interview schedule
- Setting up the ERM environment (arranging the room and the devices to be used)
- Conducting the ERM sessions with the participants
- Analysis part I: Preparation of a poster based on the selected statements and images from the sessions

- Analysis part II: Preparation of a second poster identifying potential solution areas
- Presentation of the posters

2. The ERM toolkit

The ERM toolkit includes simple and abstract 2D and 3D forms representing various potential components of an electrical tea maker and its serving set such as tea pot, handle, filter, base, spout, tea glass and saucer, etc. The components of the toolkit are brought together by putty-like adhesives such as Blue-tack or Tack-it. The toolkit also includes different materials such as colored pens and pencils, paper tape, cord, wire, play-dough, colored papers, aluminum foil, fabrics, etc. to tailor the model to the specific requests or needs of the participants. The vectorial drawings of the toolkit developed by Senem Turhan will be provided, and each team will produce its own toolkit by using the laser cutting machine in the Faculty workshops. If desired, the teams may add new elements to the toolkit.

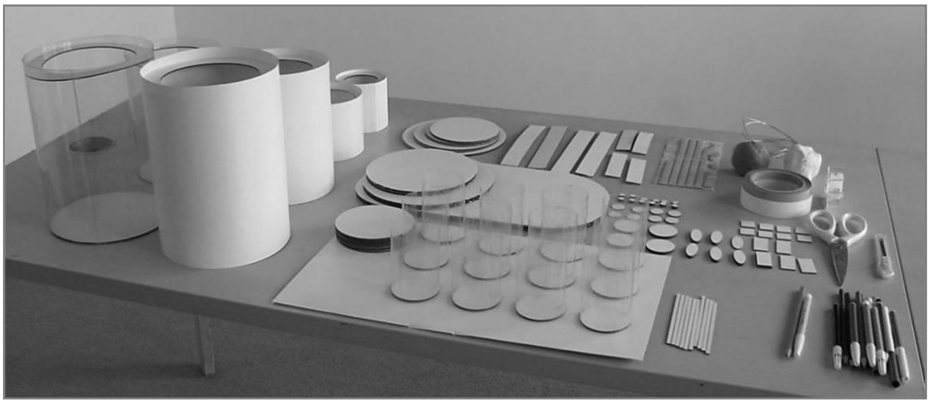

Figure H.1 The ERM toolkit

3. Analysis of ERM Sessions

The analysis of the ERM sessions will help you highlight the interesting and insightful statements made by the participants, and identify the potential solution areas. To present the results of your analysis use the poster formats provided.

Analysis part I:

Analyze the video recordings as described below and prepare the presentation board I:

- Select at least 15 video sections or fragments that you find important from the video recording of the ERM session
- Present these sections or fragments with verbatim transcriptions of the participant's statements
- Present these statements with corresponding images selected from video and/or camera recordings of the ERM session
- Provide interpretations and insights from the participant's statements
- Propose potential solution areas based on your interpretations and insights

Presentation format: 100X70 cm paper board; orientation: landscape; language: Turkish and English

Presentation board I will include information about the participant, the image of the electrical tea maker and the serving set that the participant actually uses, and the image of the electrical tea maker and the serving set that the participant has modeled during the ERM session, the selected statements of the participant and the corresponding images from the ERM session, your interpretations and insights from these statements, and your suggestions concerning the potential solution areas.

Analysis part II:

Analyze the presentation board I as described below and prepare the presentation board II:

- Categorize and present the potential solution areas under the three main sustainable design considerations in the project brief. Some solution areas might be related to more than one design consideration.
- Present your initial ideas through quick sketching in relation to the design considerations as exemplified in the sample format.

Presentation format: 100X70 cm paper board; orientation: landscape; language: Turkish and English

Presentation board II will include information about the participant, the image of the electrical tea maker and the serving set that the participant actually uses, and the image of the electrical tea maker and the serving set that the participant has modeled during the ERM session, categorization of the potential solution areas under the three main project considerations, and initial sketches.

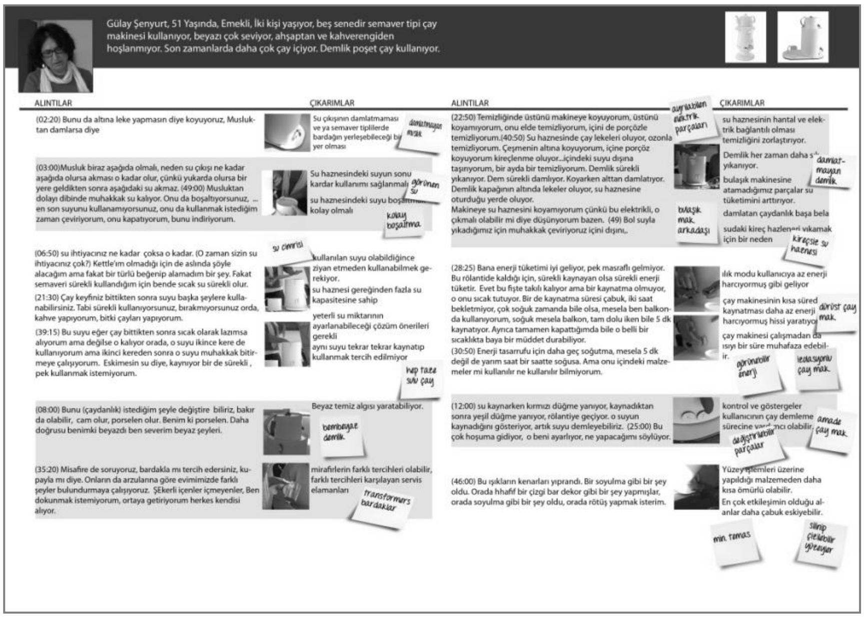

Figure H.2 The sample presentation board I

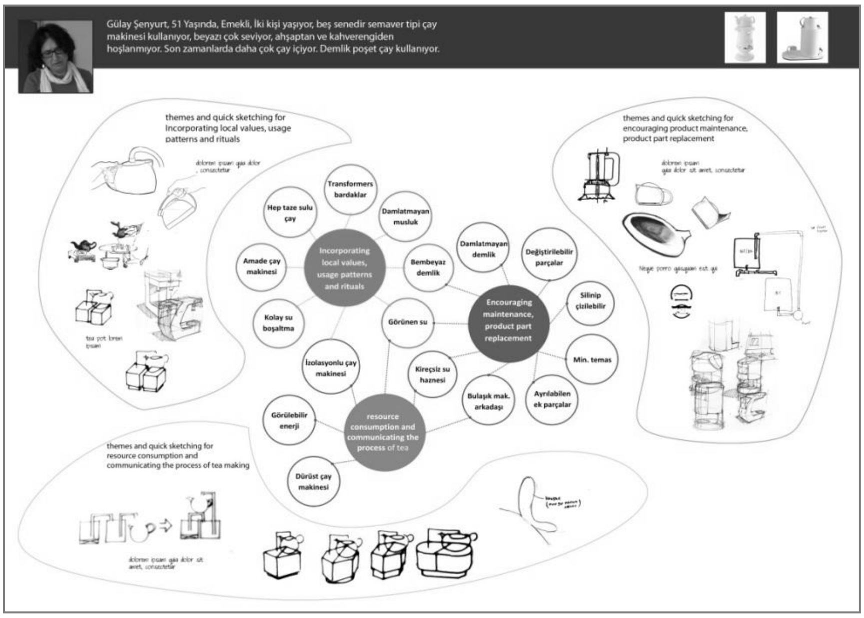

Figure H.3 The sample presentation board II

The sketches in the sample presentation board II were taken from the following sources:

Eskild Tjalve, 1979. A short course in industrial design. London: Butterworths.

http://mauritania-isabel.blogspot.com/2009/02/drinking-tea-with-moors.html

http://www.patrickhartog.com/2010/01/quick-sketches-coffee-machines/

http://ryecrowendesign.blogspot.com/2011_09_01_archive.html

http://psuedo-guru.deviantart.com/art/Kettle-Sketches-44467677

http://www.homebrewtalk.com/f51/two-kettle-system-182435/

APPENDIX I

THE ERM INTERVIEW SCHEDULE FOR MAKING TEA AN ENGAGING PRACTICE PROJECT

I.1 TURKISH

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2011-12 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Selim Gençoğlu, Part-time Inst. Mustafa Hasdoğan, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

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ODTÜ - Esse işbirliğiyle Elektrikli Çay Makinesi ve Servis Elemanları Tasarımı

Deneyim Yansıtma Modellemesi, DYM (*Experience Reflection Modeling, ERM)* Kılavuzu

Elektrikli Çay Makinesi ve Servis Elemanları Görüşme Kılavuzu

Araştırmacıya notlar
DYM sürecinde dikkat edilmesi gereken noktalar: DYM, kullanıcıların belli bir ürün ile ilgili yaşadıkları deneyimleri, görüşlerini ve tercihlerini ifade etmeleri için kurgulanmış özel bir yöntemdir. Kullanıcılar bir yandan araştırmacının yönelttiği soruları yanıtlarken bir yandan da kendilerine sağlanan setin elemanlarını kullanarak söz konusu ürünün üç boyutlu fiziksel bir modelini oluştururlar. Bu fiziksel model, kullanıcının ürünle ilgili deneyimlerini hatırlamasına ve tercihlerini somut olarak ifade etmesine yardımcı olur. DYM süreci, araştırmacının sorularına verilen yanıtlarla ve elektrikli çay makinesi ve servis elemanlarının katılımcı tarafından basamak basamak oluşturulmasıyla ilerler. Katılımcının modeli oluştururken sürece aktif katılımı esastır. Katılımcının yaptığı tercihlerin nedenlerinin öğrenilmesi önemlidir. Bu kılavuz metninde * ile işaretlenmiş sorularda araştırmacı, setin parçalarını ve oluşturulan modeli kullanması için katılımcıyı özendirmeli; ayrıca katılımcının yanıtlarından veya yaptığı tercihlerden sonra katılımcıya "Neden bunu tercih ettiniz?" "Başka bir şey tercih eder misiniz?"gibi sorular yöneltmeli ve <u>tercihlerinin</u> <u>nedenlerini</u> öğrenmelidir. Parçaların seçimi, yerleştirilmesi ve gerekirse parçalar veya model üzerinde değişiklikler yapılması konusunda araştırmacı, eğer isterse katılımcıya yardımcı olabilir. DYM süreci ekip çalışması gerektirir; süreç boyunca en az bir kişinin video çekimiyle ilgilenmesi, bir kişinin oluşturulan fiziksel modelin sık sık fotoğrafını çekmesi, bir kişinin katılımcıya soruları yöneltmesi, bir kişinin de üç boyutlu modelleme sürecinde gerekli durumlarda katılımcıya destek olması önerilir.

1. Giriş

Görüşmemize başlamadan önce size yaptığımız araştırmayla ilgili biraz bilgi vermek istiyoruz. Bizler ODTÜ Endüstri Ürünleri Tasarımı Bölümünde üçüncü sınıf öğrencisiyiz. Benim adım .... görüşmeye katılan diğer arkadaşlarım da .... ve .... Bu araştırmayı tasarım dersi kapsamında sizin elektrikli çay makinesine ve çay servisi setine yönelik görüşlerinizi öğrenmek için yapıyoruz. Bu görüşmede toplanan veriler eğitim amaçlı olarak tasarım sürecinde, tez araştırmalarında, bilimsel yayınlarda ve sunuşlarda kullanılacak. Görüşme sırasında anlattıklarınızı yalnızca bilimsel amaçlarla kullanacağız. Kimliğinizle ilgili bilgileri saklı tutacağız. Konuştuklarımızı daha sonra tam olarak hatırlayabilmek ve gözden geçirebilmek için görüşmemizi videoya kaydedeceğiz. Görüşmemiz bir saat kadar zaman alabilir.

Görüşmeye başlamadan önce sormak istediğiniz herhangi bir şey var mı?

2. DYM sürecine yönelik katılımcıyı bilgilendirme

Şimdi kısaca birlikte neler yapacağımızdan bahsetmek istiyoruz. Gördüğünüz gibi elimizde bir takım parçalar var. Bu parçalarla bir elektrikli çay makinesi ve çay servisi elemanlarını oluşturacağız. Bunları oluştururken ayrıntıları hatırlamanızı kolaylaştırmak için bir çay yapma ve sunma sürecini yaşıyormuş gibi yapacağız. Oluşturacağımız modellerin sizin kullandığınız çay makinesi ve servis elemanları olmasını beklemiyoruz, kendi ihtiyaçlarımnıza ve beklentilerinize göre yeni ve farklı ürünler oluşturabilirsiniz.

Elektrikli çay makinesi ve servis elemanlarını oluştururken bu parçaları doğrudan kullanabilirsiniz. İsterseniz kalem ve makas yardımı ile bu parçalar üzerinde değişiklikler de yapabilirsiniz. Bu parçalar dışında başka bir parça da önerebilirsiniz. Önerdiğiniz bu farklı parçaları oyun hamuru ile oluşturabiliriz. Bu süreç boyunca istediğiniz zaman biz de size yardımcı olabiliriz.

Elektrikli çay makinesinin ve servis elemanlarının parçalarını bir araya getirirken <u>sizin</u> tercih ve önerilerinizi anlamak istiyoruz. Bu nedenle aklınızdan geçenleri yüksek sesle söylemeniz sizi daha iyi anlamamıza yardımcı olacak. Oluşturduğunuz modellerde herhangi bir aşamada değiştirmek istediğiniz şeyler olursa değiştirebilirsiniz ya da bizden değiştirmemizi isteyebilirsiniz.

Başlamadan önce sürece yönelik sormak istediğiniz herhangi bir şey var mı?

3. DYM süreci

3.1 Elektrikli çay makinenizi en sık hangi zamanlarda veya durumlarda kullanırsınız? [*Eğer katılımcı karar veremiyorsa, bir önceki kullanıcı gözleminde edinilen bilgilerden yararlanarak araştırmacı bir öneri getirebilir (sabah kahvaltısında, misafir gelince, akşam yemekten sonra, kadınlar gününde, altın gününde, vb.)*]

Elektrikli çay makinesini en fazla (............) kullanıyorum demiştiniz. İsterseniz o durumu canlandırarak çay yapalım ve ikram edelim.

3.2 ***Çay hazırlamaya başlamadan önce çay makinesinin temel parçalarına karar verelim. Örneğin su haznesi ve çay haznesi hangi büyüklükte olsun? Görünüşlerinin nasıl olmalarını tercih edersiniz? Bu parçaların nasıl yerleşmesini tercih edersiniz? Neden?

3.3 Elektrikli çay makinesiyle çay yapmaya başlamadan önce ne gibi hazırlıklar yaparsınız?

Elektrikli çay makinesini pirize yakın bir yere götürür müsünüz ya da yerini değiştirir misiniz?

* Lütfen modele elektrik kablosunu yerleştirir misiniz?

3.4 (............) için kaç kişilik çay demlemek istersiniz?

Şimdi (…) kişilik çay hazırlama sürecini model üzerinden sırayla anlatır mısınız? [*Bundan sonraki soruların sırası katılımcının çay hazırlama sırasına göre değiştirilebilir.*]

3.5 * Su haznesindeki suyun miktarına nasıl karar verirsiniz?

*Suyu nereden ve nasıl doldurursunuz?

*Su haznesinin malzemesi ne olmalı? Neden?

*Su haznesinin kulbu nasıl olmalı? Neden?

* Su haznesinin kapağı nasıl olmalı? Neden?

* Su çıkış ucu nasıl olmalı? Nasıl bir su çıkışı tercih edersiniz? Neden?

3.6 * Çay makinesini ne zaman çalıştırırsınız? Nasıl çalıştırırsınız? *****Çay makinesini çalıştırdınız. Çay makinesinin çalıştığından nasıl emin olursunuz?

*Çalıştığından emin olmak için farklı bir şey tercih eder miydiniz? Neden?

3.7 *Su şu anda hazırlanıyor. Suyun hazır olduğunu nasıl anlarsınız?

3.8 * Çayınızı nasıl demlersiniz?

*Filtre kullanır mısınız? Nasıl bir filtre tercih edersiniz?

*****Çayın miktarını nasıl ayarlarsınız?

*Çayı demlemek için kullandığınız suyun sıcaklığına nasıl karar verirsiniz?

* Çayı demlemek için kullandığınız suyun miktarına nasıl karar verirsiniz?

*Su haznesinin ve demliğin yerleşiminin nasıl olmasını tercih edersiniz?

*Demliğin malzemesinin ne olmasını tercih edersiniz?

*Demliğin kulbunun nasıl olmasını tercih edersiniz? Neden?

*Kapağın nasıl olmasını tercih edersiniz? Neden?

*Su çıkış ucunun nasıl olmasını tercih edersiniz? Neden?

3.9 *Çayınız şu anda demleniyor. Demlenme sırasında ne sıklıkta, nasıl kontrol edersiniz?

*Çayın hazır olduğunu nasıl anlarsınız? [*Görsel bir bilgiyle kontol ediliyor mu?*]

Demleme süresini nasıl ayarlarsınız?

3.10 Kullandığınız diğer ürünlerle karşılaştırdığınızda elektrikli çay makinenizin enerji tüketimi nasıl?

Elektrikli çay makinenizi kullanırken –demleme öncesinde, demleme sırasında veya çayınız demlendikten sonra- enerji tüketimini azaltmak için kullandığınız yöntemler var mı?

Kullanım sırasında enerji tüketimini azaltmak için dikkat ettiğiniz şeyler var mı?

*Sizce enerji tüketimini azaltmak için elektrikli çay makinesine ne gibi özellikler eklenebilir?

3.11 *Çay hazırlama sürecine geri dönersek, diyelim ki çay demlendi, demlenme sürecinin sonunda neler yaparsınız?

*Çay makinesini ne zaman kapatırsınız, fişini çeker misiniz? Neden?

*Çayı sıcak tutmak için ne yaparsınız?

Kendi çay makinenizi kullanırken demleme veya suyun kaynaması ile ilgili bir sorun yaşadınız mı? (Örneğin, demin istediğiniz koyulukta olmaması, suyun sıcaklığının istediğiniz derecede olmaması, vb.)

*Sizce demleme ve su sıcaklığının ayarlanması süreçleri açılarından çay makinesine ne gibi özellikler eklenebilir?

*Isı ayarı yapmak ister misiniz? Nasıl?

*Zaman ayarı yapmak ister misiniz? Nasıl?

*Çay makinesi ayarlarıyla ilgili eklemek istediğiniz özellikler var mı? Neden?

3.12 *Demlenen çayın servisini nasıl yaparsınız?

Çay makinesinin bütününü ya da bir parçasını servis aşamasında başka bir yere ya da odaya taşıyor musunuz? Neden?

Çay servisini siz mi yapmayı tercih edersiniz? Başka tercihiniz var mı?

Çayın tazelenmesine, yeniden demlenmesine ihtiyaç duyar mısınız? Nasıl yapmayı tercih edersiniz?

*Servis için ek bir ürün kullanır mısınız? Neden?

*Servis için nasıl bir tepsi tercih edersiniz? Neden?

*Servis için nasıl bardaklar ve bardak altlıkları tercih edersiniz? Neden?

*Servis için nasıl çay kaşıkları tercih edersiniz? Neden?

*Servis yaparken başka ne tür ürünler ya da aksesuarlar kullanırsınız? Neden?

*Sizce servis açısından çay makinesine ve servis elemanlarına ne gibi özellikler eklenebilir?

3.13 *Elektikli çay makinesinin temizliğini nasıl yaparsınız?

*Elektikli çay makinesinin içini nasıl temizlersiniz?

*Elektikli çay makinesinin filtresini nasıl temizlersiniz?

*Elektikli çay makinesinin dışını ve kapağını nasıl temizlersiniz?

Temizlerken ne gibi zorluklarla karşılaşıyorsunuz?

*Sizce temizlik açısından elektrikli çay makinesine ne gibi özellikler eklenebilir?

3.14 Daha önce elektrikli çay makineniz bozuldu mu veya hiç servise götürdünüz mü? Neden?

Elektrikli çay makinenizin bozulmaması için, kullanırken özellikle dikkat ettiğiniz şeyler var mı? Neden?

Sizce elektrikli çay makinesi için tamir veya servis önemli mi? Neden?

Elektrikli çay makinesi ile ilgili bir kaza yaşadınız mı?

*Bir kaza yaşanmaması için elektrikli çay makinesine ne gibi özellikler eklenebilir?

3.15 *Diyelim ki bu elektrikli çay makinesini uzun süredir kullanıyorsunuz ve artık eskidiğini düşünüyorsunuz. Çay makinesini elden çıkarmadan yenileme şansınız olsaydı, hangi parçalarını yenilemek isterdiniz? Neden?

[*Katılımcı yanıt vermekte zorlanırsa*] Örneğin demliği, kordonu, kulbu, kapağı, filtresi, ayar düğmeleri veya ayar özellikleri.

3.16 *Oluşturduğunuz bu elektrikli çay makinesine ve servis elemanlarına yeni bazı özellikler ekleseydiniz, neler eklemek isterdiniz?

*Bu elektrikli çay makinesinde ve servis elemanlarında bazı iyileştirmeler yapsaydınız neler yapardınız?

[*Katılımcının bu soruyu yanıtlarken biraz zamana ihtiyacı olabilir. Katılımcının DYM sürecinde elektrikli çay makinesine veya servis elemanlarına eklediği özellikler araştırmacı tarafından hatırlatılır ve katılımcıya başka eklemek istediği bir şey olup olmadığı bir kaç kez sorulur.*]

3.17 Tüm süreçleri yeniden düşündüğümüzde, çay yapma ve çay servisi ile ilgili üzerinde yeterince konuşmadığımız veya eklemek istediğiniz herhangi bir şey var mı?

Çalışmamıza gerçekten önemli bir katkıda bulundunuz. Katıldığınız ve zaman ayırdığınız için çok teşekkür ederiz.

ODTÜ-Esse Elektrikli Çay Makinesi ve Servis Elemanları Eğitim Projesi DYM Süreci

Katılımcı Bilgileri

Görüşmeyi yapan araştırmacılar	
Görüşme tarihi	
Görüşme yeri	
Toplam görüşme süresi	
Katılımcının adı, soyadı	
Cinsiyeti	
Yaşı	
Eğitim düzeyi	
Mesleği ve işi	
Kullandığı çay makinesinin markası	
Çay makinesini kaç yıldır kullandığı	
Katılımcının sahip olduğu çay makinesinin fotoğrafı	
Katılımcının sahip olduğu servis setinin fotoğrafı	
Katılımcının DYM sürecinde oluşturduğu çay makinesinin fotoğrafları	
Katılımcının DYM sürecinde oluşturduğu servis setinin fotoğrafları	

APPENDIX I

THE ERM INTERVIEW SCHEDULE FOR MAKING TEA AN ENGAGING PRACTICE PROJECT

I.2 ENGLISH

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2011-12 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Selim Gençoğlu,

Part-time Inst. Mustafa Hasdoğan, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

METU-Esse

Experience Reflection Modeling, ERM Interview Schedule

Electrical Tea Maker with its Serving Set Interview Schedule

Notes to the researchers
Things to be taken into account during ERM sessions: The ERM is a design research method which helps users to reflect on their needs, experiences, preferences and expectations regarding a product. During the session the researcher asks questions to the participant by using the ERM schedule provided. In response to that the participant expresses her/his thoughts (i.e. she/he "thinks aloud") as she/he builds a 3D model of a particular product by using the tool kit provided. This process helps the participant to recall his/her experiences about the product and to reflect on his/her preferences and needs related to the product. It is important to understand the participant's priorities and preferences together with their reasons while she/he brings together the components of the 3D model. For the questions marked with a star (*), active involvement of the participant in the model making process should be encouraged. Additionally, the researcher should ask questions after the participant's responses such as "Why would you prefer this/that?" or "What else would you prefer?" to understand the motives behind the preferences. If the participant asks for it, the researcher may help the participant in 3D modeling process without directing him/her. ERM session requires team work; it is recommended that at least one student is responsible for video recording, one for taking pictures of the model being constructed, one for asking questions to the participant, and one for helping the participant for 3D modeling process.

1. Introduction

We would like to give you brief information about our research before starting the session. We are third year students at the METU Department of Industrial Design. My name is............. The names of the others in the session are ....,............. and .... We are conducting this research in the context of a design course and we would like to understand your opinions related to an electrical tea maker and its serving set.

The research results will only be used for educational purposes, journal publications, presentations and thesis work. We will use your explanations for scientific purposes. We will video and audio record this session in order to remember exactly what you said and did. Your personal information will be kept confidential. This session will take approximately one hour.

Is there anything you would like to ask before starting the session?

2. Information about ERM

Now, we would like to explain what we will do. As you see, we have some parts and we will build an electrical tea maker and its serving set by using these parts. In order to remember the details about tea making and serving processes, we will pretend we make and serve tea while building the model. We are not expecting that your model will look like your own electrical tea maker or your tea serving set, you may build totally different ones in accordance with your needs and expectations.

While making your model, you can use the parts provided. If you like, we can make changes on it with the help of scissors and pens. You can propose different parts rather than the ones provided. You can create new parts by using playdough. We can assist you during this session whenever you ask for it.

We would like to understand your preferences and suggestions while you bring together the components of the tea maker and its serving set. Thus, sharing your thoughts with us will help us to understand your perspective better. You can make any changes on the 3D model at any time during the sessions or ask for our assistance to make changes.

Before starting, is there anything that you would like to ask related to the session?

3. ERM Session

3.1 When do you use the electrical tea maker most often? [*If the participant can't respond, the researcher can bring forward a proposal according to the previous user observation results (at breakfast, when a guest comes, after meal, etc.)*]

You said that you used electrical tea maker mostly during (............). Let's demonstrate tea making and serving process for that particular occasion.

3.2 *Before starting preparing tea, let's decide on the main parts of the tea maker. For example, what size water tank or teapot would you prefer? How would you like their appearances to be? How would you prefer their order to be? Why?

3.3 What kind of preparations would you make before making tea with the electrical tea maker?

Would you locate the tea maker near power socket? Or would you change its location?

*Could you please place the electric cable on the model?

3.4 For how many people would you serve tea (............)?

Could you explain tea making process with the help of the 3D model? (After that, the sequence of questions might change according to the sequence of the participant's tea making process.)

3.5 * How would you decide on the amount of water in the water tank?

*From where and how would you fill water?

*Which material would you prefer for the water tank? Why?

*How would you prefer handle of the water tank to be? Why?

* How would you prefer lid of the water tank to be? Why?

* How would you prefer spout of the water tank to be? Why?

3.6 * When would you turn on the tea maker? How would you turn it on? *Assume that you turn on the tea maker. How would you be sure that the tea maker is on?

*Would you prefer something else to be sure that it is on? Why?

3.7 *Now water is getting prepared. How would you understand that the water is ready?

3.8 * How would you brew the tea?

*Would you use infuser? What kind of infuser would you prefer?

*How would you decide on the amount of tea?

*How would you decide on the temperature of the water that you use for brewing?

* How would you decide on the amount of water that you use for brewing?

* How would you like the positions of the water tank and teapot to be?

* Which material would you prefer for the teapot? Why?

* How would you prefer the handle of the teapot to be? Why?

* How would you prefer the lid of the teapot to be? Why?

* How would you prefer the spout of the teapot to be? Why?

3.9 *Your tea is brewing now. How often and how would you check the tea during brewing?

*How would you be sure that the tea is ready?

How would you adjust the time for brewing?

3.10 How is your tea maker's energy consumption in comparison to other electrical products that you use at home?

Is there any method that you use for reducing the energy consumption during the use of your tea maker (before, during, after brewing)?

Is there any measure that you take to save energy during the use of your tea maker?

*What kind of features would you like to add to the tea maker to reduce the energy consumption?

3.11 * Let's go back to the tea making process. Assume that the tea is brewed, what would you do after the brewing process?

*When would you turn off the tea maker? Would you unplug it? Why?

*What would you do to keep the tea warm?

Is there any problem that you have experienced before with your tea maker related with boiling of water or brewing the tea? (For example, having too light/too dark tea, or having too hot/ too cold water, etc.)

*What kind of features would you like to add to the tea maker for brewing tea and controlling water temperature?

*Would you like to have a temperature setting? How?

*Would you like to have a time setting? How?

*Is there any feature that you would like to add in terms of displays and controls? Why?

3.12 *How would you serve tea?

Do you carry the whole or a part of the tea maker to another place or room for serving process? Why?

Do you prefer to serve the tea by yourself? Do you have any other preferences?

Do you usually re-brew tea? How would you prefer to do this?

*Would you use additional products for serving the tea? Why?

*What kind of tray would you prefer for serving the tea? Why?

*What kind of tea glasses and saucers would you prefer for serving the tea? Why?

* What kind of tea spoons would you prefer for serving the tea? Why?

*What other accessories or products do you use for serving the tea? Why?

*What kind of features would you like to add to the tea maker and its serving set in terms of service?

3.13 *How would you clean the tea maker?

* How would you clean the inside of the tea maker?

* How would you clean the infuser of the tea maker?

* How would you clean the outside and the lid of the tea maker?

What kind of difficulties do you face during the cleaning process?

* What kind of features would you like to add to the tea maker for cleaning?

3.14 Have your tea maker ever been broken before? Or have you ever taken it to a technical service before? Why?

Is there anything you would like to do to prevent any potential damage to your tea maker? Why?

Is repair and maintenance important for the tea maker? Why?

Have you ever experienced any accident related to your electrical tea maker?

* What kind of features would you like to add to the tea maker to prevent accidents?

3.15 *Assume that you have been using this tea maker for a long time and you think that it is outdated. If there is an opportunity to renew the tea maker without discarding it which parts would you like to replace or renew? Why?

[*If the participant has difficulty to answer the question*] For example, teapot, cable, handles, control buttons, etc.

3.16 * What kind of new features would you like to add to this tea maker and its serving set?

* What kind of improvements would you make for this tea maker and its serving set?

[*The participant may need time to answer this question. The features that the participant has added to the tea maker during the session are reminded by the researcher, and the question is asked again.*]

3.17 Considering the whole process, is there anything that we didn't mention or we miss about tea making and tea serving?

Thank you very much for your participation. We really appreciate your contribution to our research.

Electrical Tea Maker with its Serving Set in Collaboration with Esse

Researchers conducted the session	
Date of the session	
Place of the session	
Duration of the session	
Name, Surname of the participant	
Gender	
Age	
Educational level	
Occupation	
Brand of the tea maker that she/he uses	
Duration of the tea maker that has been owned	
Pictures of the tea maker that the participant has	
Pictures of the serving set that the participant has	
Pictures of the tea maker that the participant has build up during the ERM session	
Pictures of the serving set that the participant has build up during the ERM session	

APPENDIX J

THE INTERVIEW SCHEDULE USED AFTER THE ERM SESSIONS

J.1 TURKISH

Tarih, saat

Ekip

Ön hazırlık

Pilot çalışmanın öğrencilere sunulması	*Size sunulan **pilot çalışmayı** değerlendirir misiniz? Bu sunuştan nasıl faydalandınız? (DYM hazırlık sürecinde ve oturumlarda)* *Bunu geliştirmeye yönelik **önerileriniz** neler?* *Ne kadar **açıklayıcı** buldunuz?* *Ne derece **yararlı** olduğunu düşünüyorsunuz?* ***Bilgilendirilmek** istediğiniz başka konular da var mıydı? Neden?*
Görüşme klavuzuna hazırlık	***DYM görüşme kılavuzuna** nasıl hazırlandınız?* *Bunu geliştirmeye yönelik **önerileriniz** neler?* *Ne kadar **açıklayıcı** buldunuz?* *Ne gibi **zorluklarla** karşılaştınız?* *DYM görüşme kılavuzuna **eklediğiniz** sorular var mı? Neler?*
Vektörel çizimin hazırlanması	*Hazırlanan **vektörel çizimi** nasıl değerlendirirsiniz?* *Ne kadar **açıklayıcı** buldunuz?* *Geliştirmeye yönelik **önerileriniz** neler?*
Modelleme setinin hazırlanması – lazer kesim makinasında setin oluşturulması	***DYM setini** nasıl bir süreçle oluşturdunuz?* *Ekip olarak sette **değişiklikler** yaptınız mı? Neden?* *Seti geliştirmeye yönelik **önerileriniz** neler?* *Modelleme setini hazırlama sürecini geliştirmeye yönelik **önerileriniz** neler?* *Ne gibi **zorluklarla** karşılaştınız?*

Oturum ortamının hazırlanması	*DYM oturumları için **mekanı** nasıl hazırladınız?* *Mekanın kullanımına yönelik **önerileriniz** neler?* *Her hangi bir **zorlukla** karşılaştınız mı?*
Katılımcıların davet edilmesi	***DYM katılımcılarını** nasıl seçtiniz? Seçerken nelere dikkat ettiniz?* *Katılımcıları davet etme sürecini anlatır mısınız? Nasıl davet ettiniz?* *DYM katılımcılarının davet edilmesi sürecine yönelik **önerileriniz** neler? Bu süreci nasıl geliştirebiliriz?* *Herhangi bir **zorlukla** karşılaştınız mı?*
Süreç – DYM oturumları	
Katılımcı ile iletişim	***Katılımcıların** DYM sürecine **katılımını** nasıl değerlendirirsiniz?* ***Modeli oluşturma** ve **soruları yanıtlama** süreçlerinde katılımcı ne derece aktifti?*
Soruları yöneltme	***Görüşme sorularını** nasıl değerlendirirsiniz?* ***Soruları** yöneltme veya görüşme sürecini geliştirmeye yönelik **önerileriniz** neler?* ***Görüşme soruları** ne derece **yeterliydi**?* *Soruları sorarken herhangi bir **zorlukla** karşılaştırnız mı?*
Modellemeye yardım etme	*DYM modelleme sürecini **katılımcının** katılımı açısından nasıl değerlendirisiniz?* ***Sizin** modelleme sürecine yardım etme konusunda katılımınızı nasıl değerlendirisiniz?* *Bu süreci geliştirmeye yönelik **önerileriniz** neler?* *Modellemeye yardımcı olurken herhangi bir **zorlukla** karşılaştınız mı?*
Dökümantasyon (fotoğraf, video çekimi	*Video, ses kaydı ya da fotograf çekimini nasıl değerlendirirsiniz?* *Sağlanan olanaklar ne derece yeterliydi?* ***Belgeleme** sürecine geliştirmeye yönelik **önerileriniz** neler?* *Herhangi bir **zorlukla** karşılaştınız mı?*
Görüşme klavuzu ve modelleme seti ilişkisi	*DYM **modelleme seti** ve **görüşme soruları** birbirini ne derece **destekledi**?* *DYM oturumunu geliştirmeye yönelik **önerileriniz** neler?* *ERM oturumunda sizi **en çok etkileyen şeyler** nelerdi?*

APPENDIX J

THE INTERVIEW SCHEDULE USED AFTER THE ERM SESSIONS

J.2 ENGLISH

Date, Time

Team

Preperation

Presentation of the pilot study	*Could you assess the* ***pilot study*** *that was presented to you? How have you been benefited from the presentation? (in terms of the ERM preperation and ERM session)* *What are your suggestions to develop the* ***presentation process****?* *To what extent was it* ***explanatory or clear****?* *To what extent was it* ***beneficial****?* *Is there anything else that you'd like to be* ***informed*** *about the pilot study? How?*
Rehearsing the ERM interview schedule	*How did you rehearse and get prepared for the* ***ERM interview schedule****?* *What are your* ***suggestions*** *for developing this process?* *To what extent is the interview schedule* ***explanatory or clear****?* *Have you experienced* ***any difficulties*** *during the rehearsing process?* *Have you* ***add any questions*** *to the schedule as a team? Which one?*
Preperation of the ERM toolkit	*Could you assess the* ***vectorial drawing*** *of the toolkit provided to you?* *To what extent was it* ***explanatory or clear****?* *What are your* ***suggestions*** *for developing the vectorial drawing?* *How did you prepare your* ***ERM toolkit****?* *Have you make any* ***modification*** *to the toolkit as a team? How?* *What are your* ***suggestions*** *for developing* ***the toolkit****?* *What are your* ***suggestions*** *for developing* ***the preperation process*** *of the toolkit?* *Have you experienced* ***any difficulties*** *during this process?*

Arranging the environment for the ERM session	*How did you arrange the* ***ERM session environment/setting****?* *What are your* ***suggestions*** *for the use of this environment/setting?* *Have you experienced* ***any difficulties*** *during the use of this environment/setting?*
Invitation the participant	*How did you decide on your* ***participant****? What were the* ***criteria*** *while* ***selecting your participant****?* *Could you explain the* ***invitation process*** *of your participant? How did you invite him/her?* *What are your* ***suggestions*** *for the invitation of the participant?* *Have you experienced* ***any difficulties*** *during this process?*
ERM session	
Communication with the participant	*Could you assess the* ***involvement*** *of the participant in the ERM session?* *To what extent was your participant active during* ***3D modelling*** *and* ***interviewing*** *processes?*
Asking the questions	*Could you assess the* ***interview questions****?* *What are your* ***suggestions*** *for the interviewing process?* *To what extent was the interview schedule* ***adequate****?* *Have you experienced* ***any difficulties*** *while asking the questions?*
Help for the modelling process	*Could you assess the* ***modelling process*** *in terms of the* ***participant's involvement****?* *In terms of* ***your involvement*** *while helping the participant during 3D modelling?* *What are your* ***suggestions*** *for the 3D modelling process?* *Have you experienced* ***any difficulties*** *during helping the participant for modelling?*
Documentation	*Could you assess the video, audio recording or taking picture processes?* *Was the provided facilities/equipments* ***adequate****?* *What are your* ***suggestions*** *to develop documentation process?* *Have you experienced* ***any difficulties*** *during documentation process?*
Relationship between the interview schedule and toolkit	*To what extent have the* ***ERM interview schedule*** *and* ***modelling toolkit*** *supported each other during the session?* *What are your* ***suggestions*** *to develop the ERM session?* *What were* ***the most impressive moments*** *in the ERM session that you have conducted today?*

APPENDIX K

THE OBSERVATION CHECKLIST FOR THE ERM SESSIONS

K.1 TURKISH

Tarih ve saat	
Ekip	
Soruları yönelten	
Modellemeye yardımcı	
Kameraman	
Fotoğrafçı	
Katılımcı	
Süre	

	NOTLAR / YORUMLAR
DYM Ortamı	
Ekipmanlar	
DYM seti	

	NOTLAR / YORUMLAR (+)	NOTLAR / YORUMLAR (-)
Katılımcının karşılanması ve oturumların başlaması		
Katılımcı ile iletişim ve etkileşim		
Soruları yöneltme		
Modellemeye yardımcı olma		
Ekip üyeleri arasındaki iletişim ve uyum		
Dökümantasyon		
Oturumların sonlandırılması		
Diğer gözlemler		

APPENDIX L

THE INTERVIEW SCHEDULE FOR THE PARTICIPANTS

Team and the participant

Have you ever participated in such a study conducted by students?

Could you assess the 3D modelling of tea maker and its serving set process?

What are your suggestions for the parts and its materials provided in the toolkit? What else can be added to the toolkit?

What are your suggestions for developing and improving the ERM 3D modelling and inteviewing processes?

What else can we do to make this process easier for you?

Grup ve Katılımcı

Daha önce, öğrenciler tarafında yürütülen böyle bir çalışmaya katıldınız mı?

Çay makinesini ve servis elemanlarını oluşturma sürecini nasıl değerlendirir siniz?

Sunulan parça ve malzemeler konusunda önerileriniz var mı? Başka neler eklenebilirdi?

DYM modelleme ve görüşme sürecinin geliştirilmesi ve iyileştirilmesi için önerileriniz var mı?

Tüm bu süreci sizin açınızdan kolaylaştırmak için başka neler yapabiliriz?

APPENDIX M

THE INTERVIEW SCHEDULE USED AFTER THE ERM

M.1 TURKISH

DYM analizleri	DYM analizlerini nasıl **değerlendirirsiniz**? Size verilen DYM analiz tanımını ne kadar **açıklayıcı** buldunuz? Ne derece **yararlı** olduğunu düşünüyorsunuz? Analiz süresinde herhangi bir **zorlukla** karşılaştınız mı?	Usefulness, Utility, constraints
Birinci Posterin hazırlanması	**Birinci posteri** hazırlarken nasıl bir **yol** izlediniz? Nasıl hazırladınız? Birinci posterin hazırlanmasına yönelik **önerileriniz** neler? Birinci posterin hazırlanması sırasında herhangi bir **zorlukla** karşılaştınız mı?	Modification, Collaboration, Communication skills, Constraints
Video Dökümü	**Video döküm** sürecini nasıl **değerlendirirsiniz**? Nasıl bir **yol** izlediniz? Videodan bölümler (alıntıları) **seçerken** nelere dikkat ettiniz? Video dökümlerini geliştirmeye yönelik **önerileriniz** neler? Döküm yaparken herhangi bir **zorlukla** karşılaştınız mı?	
Çıkarımlar	**Çıkarımlarda bulunurken** nasıl bir **yol** izlediniz? Çıkarımlarda bulunma sürecini geliştirmeye yönelik **önerileriniz** neler? Çıkarımlarda bulunma sırasında herhangi bir **zorlukla** karşılaştınız mı?	
Çözüm alanları	**Çözüm alanlarını belirlerken** nasıl bir **yol** izlediniz? Çözüm alanlarını belirleme sürecini geliştirmeye yönelik **önerileriniz** neler? Bu süreçte herhangi bir **zorlukla** karşılaştırnız mı?	
Sözel ve görsel bilginin eşleştirilmesi	Alıntı ve görselleri biraraya nasıl getirdiniz nasıl bir **yol** izlediniz? Size sunulan formatı nasıl **değerlendirirsiniz**? Bu format üzerinde **değişiklikler** yaptınız mı? Formatı geliştirmeye yönelik **önerileriniz** neler?	Adaptation, creativity

İkinci Posterin hazırlanması	**İkinci posteri** hazırlarken nasıl bir **yol** izlediniz? İkinci posterin hazırlanmasına yönelik **önerileriniz** neler? İkinci posterin hazırlanması sırasında herhangi bir **zorlukla** karşılaştınız mı?	Modification, Collaboration, Communication skills, Constraints
Kategorizasyon	**Çözüm alanlarını gruplarken** nasıl bir **yol** izlediniz? Çözüm alanlarının gruplanmasına yönelik **önerileriniz** neler? Çözüm alanlarının derlenmesi / gruplandırılması sırasında herhangi bir **zorlukla** karşılaştırnız mı?	
	Skeç yaparken nasıl bir **yol** izlediniz? Skeç yapma sürecine yönelik **önerileriniz** neler? Skeç yaparken herhangi bir **zorlukla** karşılaştırnız mı?	
Sözel ve görsel bilginin eşleştirilmesi	**Çözüm alanları** ve **skeçleri** biraraya nasıl getirdiniz nasıl bir **yol** izlediniz? Sunulan formatı nasıl **değerlendirirsiniz**? Bu format üzerinde **değişiklikler** yaptınız mı? Formatı geliştirmeye yönelik **önerileriniz** neler?	Adaptation, creativity
Sunum	**Posterlerinizi astıktan sonraki süreci** nasıl **değerlendirirsiniz**? Ne derece **yaralı** olduğunu düşünüyorsunuz? Bu süreci geliştirmeye yönelik **önerileriniz** neler? **Favori çözüm alanlarını belirlerken** nelere dikkat ettiniz? Favori çözüm alanlarını belirlerken herhangi bir **zorlukla** karşılaştınız mı?	
DYM analizleri	Analiz sürecini geliştirmeye yönelik **önerileriniz** neler? **Bilgilendirilmek** istediğiniz başka konular da var mıydı? Neler? Neden?	Lack of knowledge
DYM genel değerlendirme	DYM sürecini nasıl değerlendirirsiniz? Ne derece **yararlı** buldunuz? Ne derece **önemli** buldunuz? DYM sürecinin size ne gibi **katkıları** olabileceğini/olduğunu düşünüyorsunuz?	Useful, utility, value, worth, purpose
	DYM süreci, kullanıcıların ihtiyaç, deneyim ve beklentilerini anlamanıza ne derece **yardımcı** oldu?	learning capacity, useful, benefit
	Fikir geliştirme aşamasında ve Matrix egzersizinde DYM'den ne derece **faydalandığınızı** düşünüyorsunuz? DYM analizlerinden çıkan bilgileri ne derece fikir geliştirme sürecine **aktardığınızı** düşünüyorsunuz? Örnekler vererek açıklar mısınız?	Utility, modification, adaptation
		Curiosity,

	Gelecekte, tasarım sürecinde DYM'yi ne derece **kullanabileceğinizi** düşünüyorsunuz? Ne derece kullanmaya **merağınız, ilginiz** var? DYM yöntemini başka bir tasarım projesine nasıl **aktarabileceğinizi** düşünüyorsunuz?	adaptation – projections on future, modification
	DYM daha önceki araştırma deneyimlerinizle ne derece **benzerlikler** ve **farklılıklar** gösteriyor? Projelerden örnekler vererek açıklar mısınız?	making connections with past knowledge and experience
	DYM sürecini baştan sona değerlendirdiğinizde, sizi en çok **etkileyen** yanları neler oldu? Neden?	Interest, personal meaning
	DYM sürecini baştan sona değerlendirdiğinizde, size en **zor gelen** aşamaları neler oldu? Neden?	constraints
İş bölümü	DYM süreci boyunca ekip arkadaşlarınız arasındaki **etkileşimi ve iletişimi** nasıl değerlendirirsiniz? DYM süreci boyunca ekip arkadaşlarınızla **etkileşiminizi ve iletişiminizi** nasıl değerlendirirsiniz? Nasıl iş bölümü yaptınız? Birlikte nasıl çalıştınız? DYM de iş bölümü yaparken nelere dikkat ettiniz? Hangi kriterlere göre iş bölümü yaptınız? İş bölümü yaparken ve birlikte çalışırken ne tür zorluklarla karşılaştınız? Geliştirmeye yönelik **önerileriniz** neler?	collaboration

APPENDIX M

THE INTERVIEW SCHEDULE USED AFTER THE ERM

M.2 ENGLISH

ERM analysis	Could you assess the ERM analysis phase? To what extent was it explanatory or clear? To what extent was it beneficial?	Lack of knowledge
Preparation of the first poster	What was your approach for the preparation of the first analysis poster? How did you prepare it? What are your suggestions for the preparation phase of the first poster? Have you experienced any difficulties during the preparation of the first poster?	Usefulness
Transcription	Could you assess the transcription process of the video record? What was your strategy? What were the criteria while choosing the sections/fragments from the video? What are your suggestions for the transcription process? Have you experienced any difficulties during the transcription phase?	Utility
Insights	What was your approach for gaining/getting insights and conclusions from the participant's statements? What are your suggestions for this analysis phase? Have you experienced any difficulties during this process?	constraints
Potential design solution areas	What was your approach for developing potential design solution areas? What are your suggestions for this phase? Have you experienced any difficulties during this phase?	
Relating verbal with visual	What was your approach in relating the participant's statements with the visuals? Could you assess the exemplary format provided for the first poster? Have you made any changes or modification on the format? How? What are your suggestions for developing the format further?	Modification

Preparation of the second poster	What was your approach for the preparation of the second analysis poster? How did you prepare it? What are your suggestions for the preparation phase of the second poster? Have you experienced any difficulties during this phase?	Collaboration,
Categorization	What was your approach for the categorization and arrangement of the potential design solution areas? What are your suggestions for this categorization process? Have you experienced any difficulties during this phase?	Communication skills,
	What was your approach for sketching? What are your suggestions for the sketching process? Have you experienced any difficulties during this phase?	Constraints
Relating verbal data with visual one	What was your approach in bringing together the sketches with the potential design solution areas? Could you assess the exemplary format for the second poster? Have you make any changes or modification on the format? How? What are your suggestions for developing the format further?	
Presentation	Could you assess the process after you pin-up your presentation boards? To what extent was it beneficial? What are your suggestions for this process? What was your approach in selecting your favourite design solution areas? Have you experienced any difficulties during this phase?	
ERM analysis	What are your suggestions to develop the analysis process? Have you experienced any difficulties during the analysis process? Was there anything else that you'd like to be informed about the analysis? What kind of? How?	Lack of knowledge
Assessment of the ERM	Could you assess the ERM process as a whole? To what extent was it beneficial? To what extent was it significant? What were/would be the benefits of the ERM?	
	To what extent was the ERM beneficial to understand the user's needs, experiences and preferences?	Adaptation, creativity
	To what extent did you benefit from the ERM during Matrix exercise? To what extent did you transfer the outcomes of the ERM analysis to the idea generation phase? Could you give examples from your design ideas?	Modification,
	To what extent would you use the ERM in your design	Collaboration,

	practice in the future? To what extent is the ERM applicable to other design projects? To what extent are you willing to use the ERM? How would you transfer/adapt the ERM process to another design project?	
	What are the similarities and differences between the ERM and your prior design research experience? Could give examples from the previous projects?	Communication skills,
	When you consider the ERM process from the beginning to the end, what are the most remarkable and inspiring aspect of the ERM? Why?	Constraints
	When you consider the ERM process from the beginning to the end, what are the most difficult phases in the ERM? Why?	
Division of labour	Could you assess the communication and interaction among your team members during the ERM phase? Could you assess your communication and interaction with your team members during the ERM phase? How did you make the division of labour? How did you work together? What were the criteria for the division of labour? Have you experienced any difficulties during making the division of labour and working together? What are your suggestions for the team work?	

APPENDIX N

THE QUESTIONNAIRE USED AFTER THE ERM

N.1 TURKISH

Geçen dönem yaptığınız Elektrikli Çay Makinesi ve Servis Elemanları projesinde, literatür araştırması ve kullanıcı gözlemleri ile Matrix fikir geliştirme egzersizi arasında, kullanıcı ihtiyaç, beklenti ve önceliklerini belirlemek amacıyla Deneyim Yansıtma Modellemesi (Experience Reflection Modelling - ERM) yöntemini kullanmıştınız. Bu süreçte 5-6 kişilik ekipler ile çalıştınız. ERM toplam üç hafta sürdü.

Bu yöntemi uygulamaya başlamadan önce size yöntemi tanıtan ve ERM süreçlerini anlatan bir metin (ERM brief) dağıttık ve sonra süreci anlatan bir sunum yaptım. Bu sunumda, süreçle ilgili bilgilerin yanı sıra daha önceden yaptığım bir pilot çalışmanın videolarını da sundum.

Sunumdan sonraki derste önceden hazırladığım ERM modelleme setini ve setin çizimlerinin olduğu bir Rhino dosyasını sizle paylaştım ve siz de bir hafta boyunca kendi setlerinizi hazırladınız.

Bu sırada, önceden kullanıcı gözlemlerini yaptığınız bir katılımcıyı ERM oturumuna çağırdınız. ERM oturumları randevulu olarak U-Test'te iki gün boyunca yapıldı. Oturumlar 30 ile 60 dakika arasında sürdü. Oturumda size önceden verdiğimiz görüşme kılavuzunu kullanarak katılımcınıza çay demleme ve servis etme süreçleri ile ilgili sorular sordunuz. Katılımcınız bir yandan sorulara cevap verirken bir yandan da ERM modelleme setini kullanarak kendi modelini oluşturdu. Oturum video kamera, ses kayıt cihazı ve fotoğraf makinesi ile kayıt altına alındı.

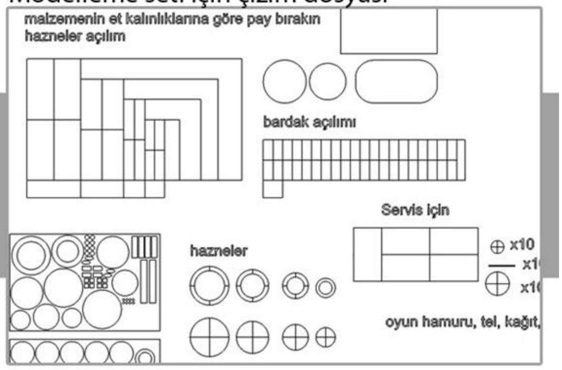
Daha sonra oturumların analiz süreci başladı. ERM briefinde analiz sürecinin nasıl olacağını verilen örnek analiz posterleriyle anlatmaya çalışmıştık. Analiz süreci iki aşamalıydı. İlk aşamada ekip olarak kendi oturumunuzdan önemli bulduğunuz en az 15 alıntıyı yazdınız, her bir alıntıyı ilgili görsel ile desteklediniz ve bu alıntılardan çıkarımlar yaptınız. Daha sonra çıkarımlardan bir kaç kelime ile olası tasarım çözüm alanlarını belirlediniz. Bu süreç stüdyo saatinde başladı. Bir sonraki derse de ikinci posterinizi tamamlamanız istendi. İkinci posterde belirlediğiniz tasarım çözüm alanlarını proje başında verilen ölçütlere göre grupladınız. Daha sonra çözüm alanlarınıza cevap olabilecek tasarım çözümlerinizi skeç yaparak anlattınız. Dersin sonunda her ekip posterlerini astı ve her biriniz tüm posterleri inceleyerek her ölçütten en az bir tane olmak üzere favori çözüm alanlarınızı seçtiniz.

Sunumdan bir slayt

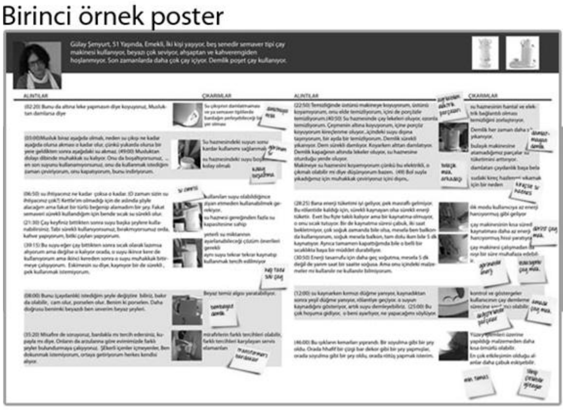
Sunumdaki video örneklerinden biri

Örnek modellme seti

Modelleme seti için çizim dosyası



Birinci örnek poster



İkinci örnek poster

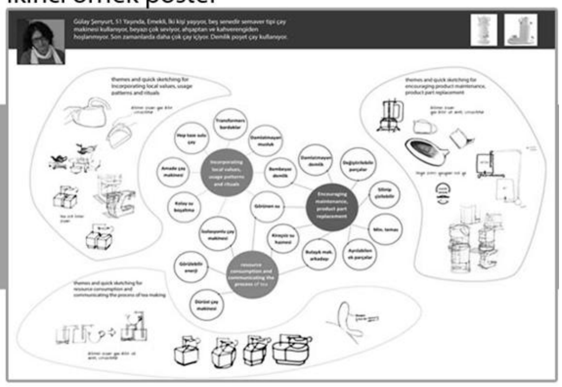


Figure N.1 Snapshots from the ERM phases to remind the process

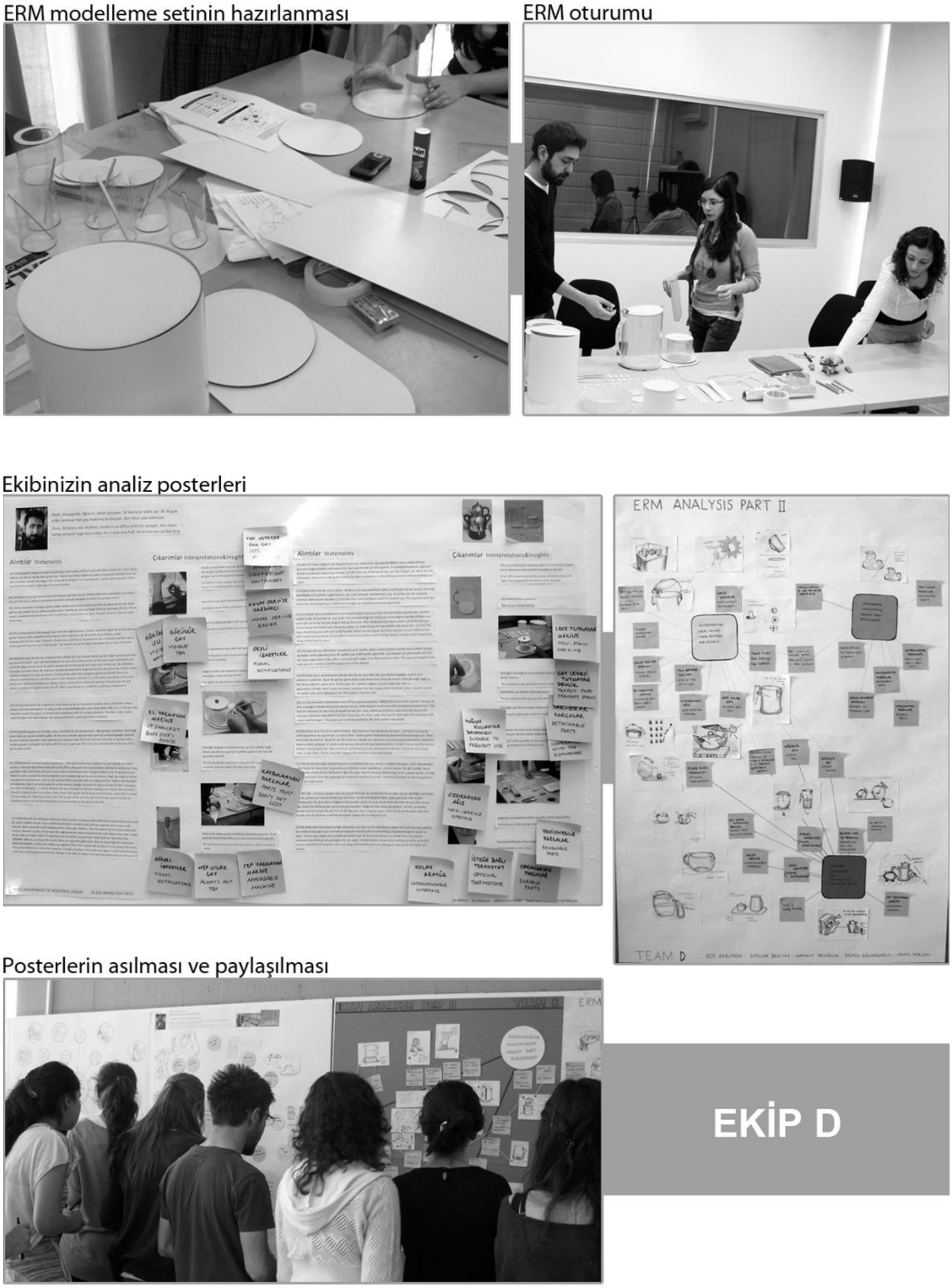


Figure N.2 Snapshots of the student team's work to remind the process

Katılımcının adı:

Ekte sunulan anket ODTÜ, Endüstri Ürünleri Tasarımı Bölümü'nde yürütülmekte olan bir doktora çalışması kapsamında hazırlanmıştır. Verdiğiniz cevaplar sadece akademik amaçlı çalışmalarda kullanılacaktır. Vereceğiniz bilgiler doğru ya da yanlış olarak değerlendirilmeyeceğinden, size en uygun gelen seçenekleri işaretlemeniz çalışmanın başarısı açısından önemlidir. Teşekkürler.

Senem Turhan

Aşağıdaki verilen her bir ifadede size uygun gelen şeçeneği işaretleyiniz.

		1	2	3	4	5
		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
1	En başta yapılan sunum ERM süreçlerini anlamamı sağladı	☐	☐	☐	☐	☐
2	ERM süreçlerini anlatan metin (brief) ERM süreçlerini açıkladı	☐	☐	☐	☐	☐
3	ERM oturumunda iş bölümünün nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
4	Sunumda gösterilen pilot çalışmaya ait video örnekleri ERM oturumunu anlamama yardımcı oldu	☐	☐	☐	☐	☐
5	ERM oturumu için provanın nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
6	ERM oturumu için planlanan prova süresi fazlaydı	☐	☐	☐	☐	☐
7	Görüşme kılavuzundaki sorular ürünün kullanım süreçlerini anlamama yardımcı oldu	☐	☐	☐	☐	☐
8	Görüşme kılavuzunun başında yer alan katılımcıyı bilgilendirme bölümü uzundu	☐	☐	☐	☐	☐
9	Görüşme kılavuzu, soruların takip edilebilmesine olanak verdi	☐	☐	☐	☐	☐
10	Görüşme kılavuzu yeni sorular eklemeyebilmemize olanak verdi	☐	☐	☐	☐	☐
11	Görüşme kılavuzu, katılımcıyı hangi aşamalarda modele yönlendireceğimiz konusunda açıktı	☐	☐	☐	☐	☐
12	Modelleme setinin oturumda nasıl kullanılacağı açıktı	☐	☐	☐	☐	☐
13	Modelleme seti için verilen çizim dosyası seti hazırlamak için yeterliydi	☐	☐	☐	☐	☐
14	Modelleme setindeki malzemeler ve parçalar, katılımcının söylediklerini model üzerinde yansıtması için yeterliydi	☐	☐	☐	☐	☐

		1	2	3	4	5
		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
15	Parçaları birleştirmek için kullanılan Tack-it ürünü yeterliydi	☐	☐	☐	☐	☐
16	Modelleme seti yeni malzemeler ekleyebilmemize olanak verdi	☐	☐	☐	☐	☐
17	Modelleme setini hazırlama süresi fazlaydı	☐	☐	☐	☐	☐
18	ERM oturumunda, modelleme setinin masa üzerindeki yerleşimi uygundu	☐	☐	☐	☐	☐
19	Modelleme setinin soyut ve basit parçalardan oluşması katılımcımızın aktif katılımını destekledi	☐	☐	☐	☐	☐
20	ERM oturumunda, modelleme sürecinin masa başında oturularak yapılması uygundu	☐	☐	☐	☐	☐
21	ERM oturumu için ÜTEST ortamı uygundu	☐	☐	☐	☐	☐
22	ERM oturumunda ÜTEST ortamı katılımcının aktif katılımını destekledi	☐	☐	☐	☐	☐
23	Oturumların ÜTEST ortamında yapılması odaklanmamı sağladı	☐	☐	☐	☐	☐
24	Video kameranın yerleşimi üç boyutlu modelleme sürecini kaydetmek için uygundu	☐	☐	☐	☐	☐
25	Oturumda çektiğimiz fotoğraflar modelleme sürecini aktarmak için yeterliydi	☐	☐	☐	☐	☐
26	Verilen birinci örnek poster analiz sürecini anlamamı sağladı	☐	☐	☐	☐	☐
27	Verilen ikinci örnek poster analiz sürecini anlamamı sağladı	☐	☐	☐	☐	☐
28	ERM analizinde, çıkarımların nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
29	ERM analizinde, tasarım çözüm alanlarının nasıl geliştirileceği açıktı	☐	☐	☐	☐	☐
30	ERM analizinde verilen üç kategori (proje ölçütleri) açıktı	☐	☐	☐	☐	☐
31	ERM analizinde, çözümün (katılımcının söylediklerinin bilgisayar ortamına aktarılması) nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
32	ERM analizinde, skeçlerin nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
33	Birinci posterin yazı ağırlıklı olması analiz sürecini destekledi	☐	☐	☐	☐	☐
34	Birinci posteri hazırlamak için kolaj uygun bir yöntemdi	☐	☐	☐	☐	☐
35	Seçtiğimiz alıntı sayısı azdı	☐	☐	☐	☐	☐
36	Analiz sürecinde katılımcının söylediklerini kelimesi	☐	☐	☐	☐	☐

		1	2	3	4	5
		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
	kelimesine yazmak onu anlamamıza yardımcı oldu					
37	Alıntıların uzun olması birinci posterin okunabilirliğini azalttı	☐	☐	☐	☐	☐
38	Tasarım çözüm alanlarımız verilen kategoriler (proje ölçütleri) ile ilişkiliydi	☐	☐	☐	☐	☐
39	Birden fazla kategoriye ait çözüm alanlarımızı ikinci postere yerleştirirken zorlandık	☐	☐	☐	☐	☐
40	Birden fazla çözüm alanına ait skeçleri ikinci postere yerleştirirken zorlandık	☐	☐	☐	☐	☐
41	ERM oturumu, ikinci posterde fikir geliştirmemi destekledi	☐	☐	☐	☐	☐
42	Alıntılar, ikinci posterde fikir geliştirme aşamamı destekledi	☐	☐	☐	☐	☐
43	Çıkarımlar, ikinci posterde fikir geliştirme aşamamı destekledi	☐	☐	☐	☐	☐
44	Tasarım çözüm alanları, ikinci posterde fikir geliştirmemi destekledi	☐	☐	☐	☐	☐
45	Birinci örnek poster, kendi özgün posterimizi oluşturmamıza olanak verdi	☐	☐	☐	☐	☐
46	İkinci örnek poster, kendi özgün posterimizi oluşturmamıza olanak verdi	☐	☐	☐	☐	☐
47	Analiz sürecine kendi bilgi ve deneyimlerimizi yansıttık	☐	☐	☐	☐	☐
48	Analiz süresince katılımcının oturumda getirdiği önerilere bağlı kaldık	☐	☐	☐	☐	☐
49	Birinci posterin hazırlanma süresi fazlaydı	☐	☐	☐	☐	☐
50	Diğer ekiplerin ERM posterlerinin stüdyoda asılarak paylaşılması fikir geliştirme sürecimi destekledi	☐	☐	☐	☐	☐
51	Diğer ekiplerin birinci posterlerinden yararlandım	☐	☐	☐	☐	☐
52	Diğer ekiplerin ikinci posterlerinden yararlandım	☐	☐	☐	☐	☐
53	ERM süreci, Matrix egzersizini destekledi	☐	☐	☐	☐	☐
54	Diğer ekiplerin ERM oturumlarını izlemek isterdim	☐	☐	☐	☐	☐
55	Önceden ERM oturumu hakkında bilgi verilmesi katılımcımızın aktif katılımını arttırırdı	☐	☐	☐	☐	☐
56	Analiz sürecine geçmeden önce çay makinesi hakkındaki teknik bilgimin desteklenmesini isterdim	☐	☐	☐	☐	☐
57	Birinci posterde katılımcının kullandığı ürünle ilgili daha detaylı bilgi verilmesini isterdim	☐	☐	☐	☐	☐

		1	2	3	4	5
		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
58	ERM analizlerinde diğer ekiplerle fikir alışverişi yapmak isterdim	☐	☐	☐	☐	☐
59	İkinci posterin hazırlanma süresi için daha fazla zaman ayrılmasını isterdim	☐	☐	☐	☐	☐
60	Diğer ekiplerin ERM posterlerini sunmalarını isterdim	☐	☐	☐	☐	☐
61	Diğer ekiplerin ERM posterlerinin paylaşımı için daha fazla sürenin ayrılmasını isterdim	☐	☐	☐	☐	☐

APPENDIX N

THE QUESTIONNAIRE USED AFTER THE ERM

N.2 ENGLISH

Last semester within the context of Electrical Tea Maker and Its Serving Set project, the ERM (Experience Reflection Modelling) method was used between the user observations and the idea generation exercise (Matrix) to understand user needs, expectations and preferences. You worked as a team in the ERM research method. This process lasted three weeks.

Before starting the ERM, we handed out the ERM brief that introduced you the ERM method and its phases. Then, I made a presentation. In this presentation, along with the information about the ERM, I presented the selected videos from the pilot study that I had conducted.

After the presentation, I shared a sample toolkit and its drawing file. You prepared your toolkit in a week.

At the same time, you recruited a participant that you met during user observations. The scheduled ERM sessions were held at the UTEST in two days. The sessions lasted in between 30 and 60 minutes. You asked questions about tea brewing and serving by using an interview schedule provided. In response to that, your participant expressed her thoughts as she brought together the components of a tea maker and accessories by using the toolkit provided. The session was documented by camera, video and audio recorders.

Then, the ERM analysis phase started. We tried to explain the process through the sample posters in the brief. The analysis phase had two parts. In the first part, as a team, you transcribed at least 15 quotes of your participant that you found significant. You supported each quote with the corresponding images and you gained and provided insights into these quotes. And then, you developed potential design solution areas from your insights. This process started in the studio hours.

You were asked to finish your second posters at the end of the next studio class. In the second poster, you categorized your design solution areas under three design considerations, and presented your initial ideas through quick sketching in relation to the design solution areas and design considerations. At the end of this session, each team pinned up their posters on the boards at the studio, and each student selected and marked at least one favourite design solution areas for each design consideration.

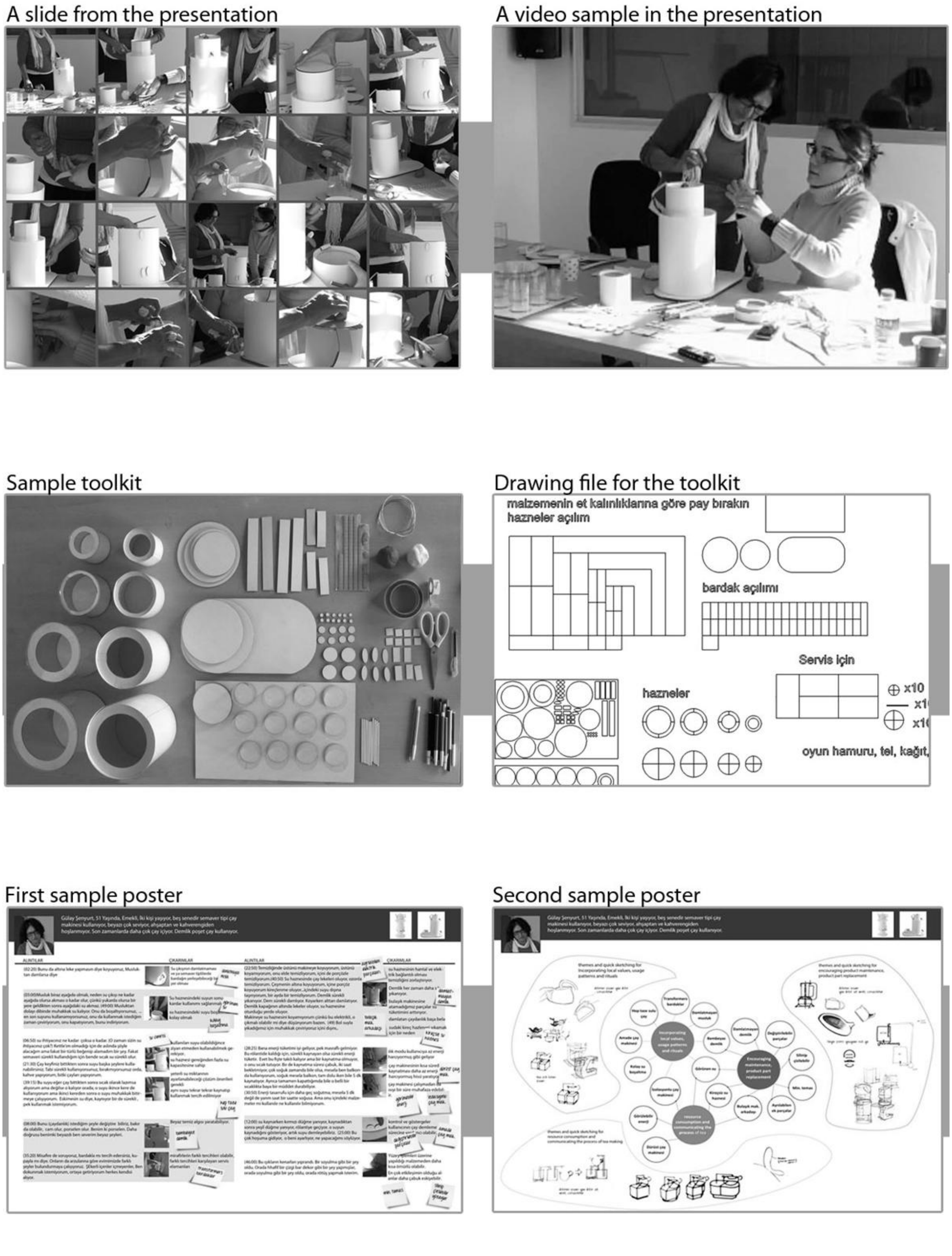


Figure N.3 Snapshots from the ERM phases to remind the process (English)

Figure N.4 Snapshots of the student team's work to remind the process (English)

Name of the participant:

This questionnaire was prepared within the Ph.D. thesis study conducted at the Department of Industrial Design, METU. Answers will only be used for academic purposes and your name will not be mentioned for any purpose in the final study. Your answers will not be assessed whether true or false. Thank you for your time and consideration.

Senem Turhan

For each statement, please check the one answer that fits you best.

		1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	The presentation at the beginning helped me understand the ERM phases.	☐	☐	☐	☐	☐
2	The brief describing the ERM phases was clear.	☐	☐	☐	☐	☐
3	How to make the division of labour at the ERM session was clear.	☐	☐	☐	☐	☐
4	The selected videos from the pilot study helped me understand the ERM session.	☐	☐	☐	☐	☐
5	How to rehearse for the ERM session was clear.	☐	☐	☐	☐	☐
6	The time period dedicated for the rehearsal was long.	☐	☐	☐	☐	☐
7	The questions in the interview schedule helped me understand the use phases of a tea maker.	☐	☐	☐	☐	☐
8	Introduction parts at the beginning of the interview schedule which informed the participant about the study was long.	☐	☐	☐	☐	☐
9	The interview schedule enabled us to follow the questions.	☐	☐	☐	☐	☐
10	The interview schedule enabled us to add new questions.	☐	☐	☐	☐	☐
11	The interview schedule was clear about in which the phases we led the participant to the 3D modelling.	☐	☐	☐	☐	☐
12	How to use the ERM toolkit in the session was clear.	☐	☐	☐	☐	☐
13	The drawing file (toolkit_tea_maker.3dm) for the ERM toolkit was adequate for the preparation of the toolkit.	☐	☐	☐	☐	☐
14	The parts and materials in the ERM toolkit were adequate for the participant to reflect her/his responses on the 3D model.	☐	☐	☐	☐	☐

		1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
15	Tack-it was an adequate tool to connect parts in the toolkit.	☐	☐	☐	☐	☐
16	The ERM toolkit enabled us to add new materials and parts.	☐	☐	☐	☐	☐
17	The time period dedicated to the preparation of the toolkit was long.	☐	☐	☐	☐	☐
18	The arrangement of the toolkit on the table was adequate at the ERM session.	☐	☐	☐	☐	☐
19	Abstract and basic parts in the toolkit supported the active involvement of our participant.	☐	☐	☐	☐	☐
20	Conducting the 3D modelling process by sitting close to the ERM toolkit was adequate at the ERM session.	☐	☐	☐	☐	☐
21	UTEST environment for the ERM session was adequate.	☐	☐	☐	☐	☐
22	UTEST environment supported the active involvement of the participant at the ERM session.	☐	☐	☐	☐	☐
23	Conducting the ERM session at UTEST enabled us to concentrate.	☐	☐	☐	☐	☐
24	The location of the camera was adequate for recording the 3D modelling process.	☐	☐	☐	☐	☐
25	The pictures that we took during the ERM session were adequate to convey the 3D modelling process.	☐	☐	☐	☐	☐
26	Provided first sample poster enabled me to understand the analysis phase.	☐	☐	☐	☐	☐
27	Provided second sample poster enabled me to understand the analysis phase.	☐	☐	☐	☐	☐
28	How to gain insights from the participant's statements for the first poster during the ERM analysis phase was clear.	☐	☐	☐	☐	☐
29	How to develop design solution areas at the ERM analysis was clear.	☐	☐	☐	☐	☐
30	Three categories (design considerations) given for the ERM analysis were clear.	☐	☐	☐	☐	☐
31	How to transcribe the participant's response at the ERM analysis was clear.	☐	☐	☐	☐	☐
32	How to sketch at the ERM analysis phase was clear.	☐	☐	☐	☐	☐
33	Text-based first sample poster supported my analysis phase.	☐	☐	☐	☐	☐
34	Collage was an adequate technique for the preparation of the first poster.	☐	☐	☐	☐	☐
35	The number of selected quotes for the first poster was few.	☐	☐	☐	☐	☐

		1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
36	The full transcription of the participant's responses enabled us to understand her/him.	☐	☐	☐	☐	☐
37	The length of the selected quotes reduced the readability of the first poster.	☐	☐	☐	☐	☐
38	Our design solution areas were related with the given categories (design considerations).	☐	☐	☐	☐	☐
39	We had difficulty in placing the design solution areas related with more than one category on the second poster.	☐	☐	☐	☐	☐
40	We had difficulty in locating the sketches related with more than one design solution areas.	☐	☐	☐	☐	☐
41	The ERM session supported my idea generation in the second poster.	☐	☐	☐	☐	☐
42	The selected quotes supported my idea generation in the second poster.	☐	☐	☐	☐	☐
43	The insights that we developed supported my idea generation in the second poster.	☐	☐	☐	☐	☐
44	The design solution areas that we developed supported my idea generation in the second poster.	☐	☐	☐	☐	☐
45	First sample poster enabled us to develop/modify/create our unique poster.	☐	☐	☐	☐	☐
46	Second sample poster enabled us to develop/modify/create our unique poster.	☐	☐	☐	☐	☐
47	We incorporated our knowledge and skills into the ERM analysis.	☐	☐	☐	☐	☐
48	During the ERM analysis, we only took into consideration the participant's solutions that she generated at the ERM session.	☐	☐	☐	☐	☐
49	The time period dedicated to the preparation of the first poster was long.	☐	☐	☐	☐	☐
50	Hanging the other teams' posters on the boards at the studio supported my idea generation phase.	☐	☐	☐	☐	☐
51	I benefited from the other teams' first posters.	☐	☐	☐	☐	☐
52	I benefited from the other teams' second posters.	☐	☐	☐	☐	☐
53	The ERM method supported the Matrix exercise.	☐	☐	☐	☐	☐
54	I wish I would have seen the other teams' ERM sessions.	☐	☐	☐	☐	☐
55	Informing the participant about the ERM session beforehand would increase the active involvement of her/him.	☐	☐	☐	☐	☐
56	I wish my technical knowledge about a tea maker	☐	☐	☐	☐	☐

		1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	would be supported before the ERM analysis.					
57	I wish more detailed information about the product that the participant used would be given at the first poster.	☐	☐	☐	☐	☐
58	I wish I would exchange ideas with other teams during the ERM analysis.	☐	☐	☐	☐	☐
59	I wish the time period dedicated to the second poster would be much more.	☐	☐	☐	☐	☐
60	I wish all teams would present their posters to the studio.	☐	☐	☐	☐	☐
61	I wish the time period dedicated to the sharing of the other teams' posters would be much more.	☐	☐	☐	☐	☐

APPENDIX O

THE RELIABILITY STATICS OF THE QUESTIONNAIRE

Case Processing Summary

		N	%
Cases	Valid	32	97,0
	Excluded[a]	1	3,0
	Total	33	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,813	61

```
DESCRIPTIVES VARIABLES=Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13
Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30
Q31 Q32 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40 Q41 Q42 Q43 Q44 Q45 Q46 Q47
Q48 Q49 Q50 Q51 Q52 Q53 Q54 Q55 Q56 Q57 Q58 Q59 Q60

Q61

  /STATISTICS=MEAN STDDEV.
```

APPENDIX P

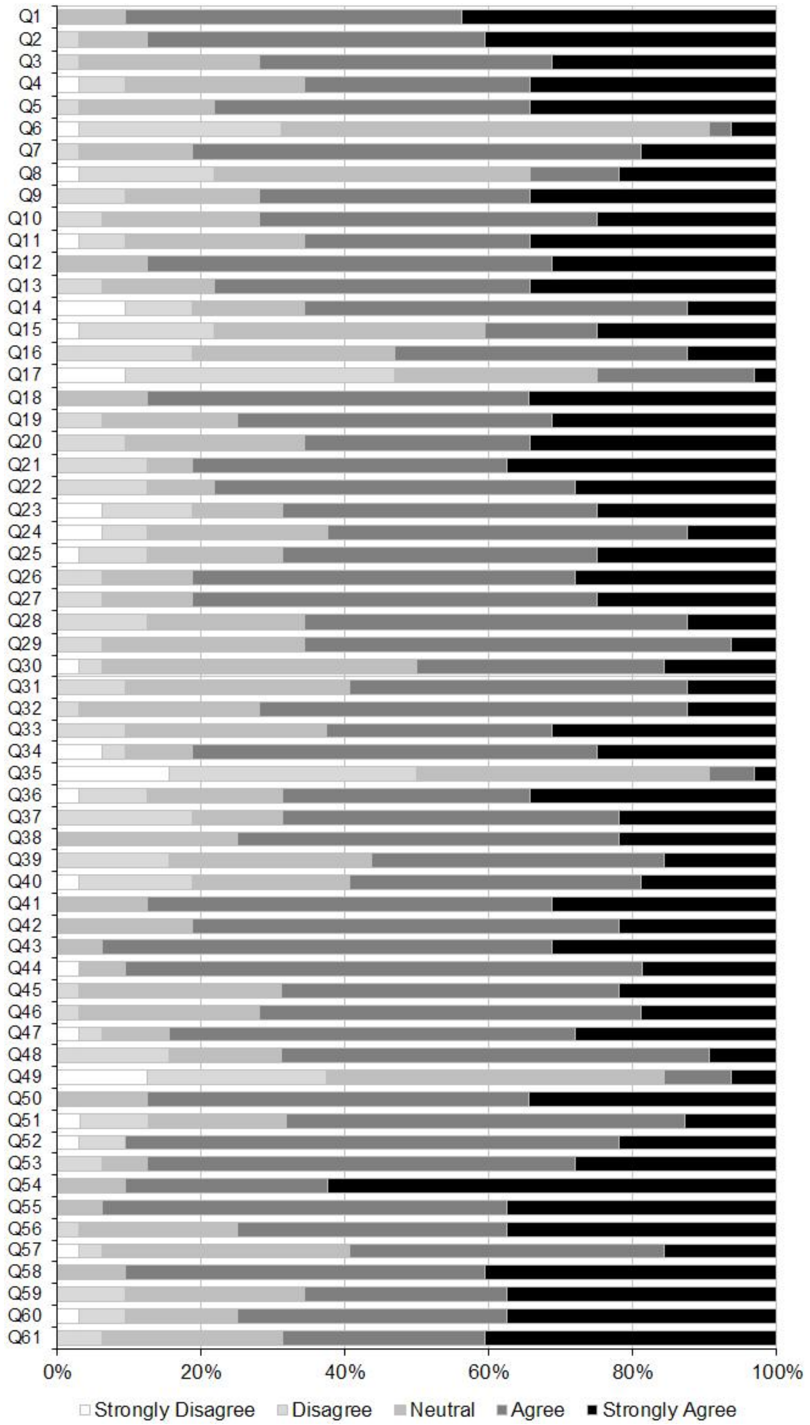
THE DESCRIPTIVE STATICS OF THE QUESTIONNAIRE

	N	Mean	Std. Deviation
Q1	32	4,34	,653
Q2	32	4,25	,762
Q3	32	4,00	,842
Q4	32	4,59	,798
Q5	32	4,09	,818
Q6	32	2,81	,821
Q7	32	3,97	,695
Q8	32	3,31	1,120
Q9	32	3,97	,967
Q10	32	3,91	,856
Q11	32	3,87	1,070
Q12	32	4,19	,644
Q13	32	4,06	,878
Q14	32	3,50	1,136
Q15	32	3,41	1,160
Q16	32	3,47	,950
Q17	32	2,72	1,023
Q18	32	4,22	,659
Q19	32	4,00	,880
Q20	32	3,91	,995
Q21	32	4,06	,982
Q22	32	3,94	,948
Q23	32	3,69	1,176
Q24	32	3,56	1,014
Q25	32	3,78	1,039
Q26	32	4,03	,822
Q27	32	4,00	,803
Q28	32	3,66	,865
Q29	32	3,66	,701

	N	Mean	Std. Deviation
Q30	32	3,56	,914
Q31	32	3,63	,833
Q32	32	3,81	,693
Q33	32	3,84	,987
Q34	32	3,91	1,027
Q35	32	2,47	,950
Q36	32	3,88	1,100
Q37	32	3,72	1,023
Q38	32	3,97	,695
Q39	32	3,56	,948
Q40	32	3,56	1,076
Q41	32	4,19	,644
Q42	32	4,03	,647
Q43	32	4,25	,568
Q44	32	4,03	,740
Q45	32	3,88	,793
Q46	32	3,88	,751
Q47	32	4,03	,897
Q48	32	3,62	,871
Q49	32	2,72	1,023
Q50	32	4,22	,659
Q51	32	3,66	,937
Q52	32	4,00	,880
Q53	32	4,09	,777
Q54	32	4,53	,671
Q55	32	4,31	,592
Q56	32	4,09	,856
Q57	32	3,66	,902
Q58	32	4,31	,644
Q59	32	3,94	1,014
Q60	32	4,00	1,047
Q61	32	4,03	,967
Valid N (listwise)	32		

APPENDIX Q

THE CENTRAL TENDENCY GRAPH OF ALL ITEMS IN THE QUESTIONNAIRE



APPENDIX R

ENGAGING AND SUSTAINABLE DESIGN SOLUTIONS FOR TEA MAKING AND SERVING EXPERIENCE PROJECT BRIEF

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2012-13 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Mustafa Hasdoğan, Part-time Inst. Dr. Harun Kaygan, Res. Asst. Koray Benli, Res. Asst. M. Erdi Özgürlük, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

Term Project Brief

Engaging and Sustainable Design Solutions for Tea Making and Serving Experience in collaboration with Vestel

Electrical tea makers have been becoming effective and more preferable alternatives to conventional teapots used in households in Turkey. The current electrical tea maker designs along with its serving accessories (e.g. tea glass and saucer, tea spoon, sugar bowl, tea cup or mug, tray, etc.) need to be re-evaluated and revisited in accordance with sustainable design considerations. Current electrical tea makers and serving accessories have followed different paths of development as products. Although tea making and serving are essential and complementary aspects of tea experience, these products are usually separately designed, produced and marketed. From designers' point of view, on the other hand, tea making and serving as a unified experience offers new and fresh solution areas to explore.

The main goal of this project is to reframe making and serving tea as an enriching experience, and to develop engaging design solutions which reinforce local values, encourage maintenance and repair, and raise awareness about consumption of resources.

Incorporating local values, usage patterns and rituals: Design solutions informed and inspired by the local values, conventions, rituals, habits and usage patterns related to tea making and serving enrich user experience and product-user interaction, and encourage personalization. These local values and needs manifest themselves at various phases of use (e.g. preparing, brewing and serving the tea; cleaning the tea maker, the tools and the accessories, etc.).

Encouraging product maintenance and product part replacement: Ease of maintenance and cleaning, replacing or renewing outdated or worn-out parts <u>technically and/or aesthetically</u> empower users, support product engagement and prolong product life span.

Understanding resource consumption patterns and communicating the process of tea making: Understanding resource consumption patterns, raising awareness about water and energy efficiency, making the use and consumption of resources visible, and communicating the various phases of tea making process promote engaging and affordable design solutions, and encourage changes in user behavior in line with responsible consumption patterns.

Project Phases

Literature search and user observation (team): Prior to idea generation phase, one of the main stages of this project is literature search and user observation which will be conducted in teams. The literature search includes a review and analysis of various topics related to the project context. User observation phase covers user visits, interviews and observations, and will be conducted in private homes, dormitories or small workplaces to observe and record the use, maintenance and storage of tea makers and related accessories from diverse brands to identify problems and gain insights into the usage patterns. Based on the results of the literature search and user observations, the student teams will present insights, findings and project dimensions.

Disassembly and re-assembly session: Two different electrical tea makers will be disassembled, all the inner parts will be identified, working principles and details will be explained, and frequent user complaints and product failures will be discussed. The process will be facilitated by an experienced service technician.

Experience Reflection Modeling (ERM) sessions (team): The student teams will conduct exploratory ERM sessions with the participants that they have met during the user observation phase. The ERM will be used as a design research method which helps users express and externalize their experiences related to the tea making and the whole life span of a tea maker. Hereby, it helps students understand users' experiences, expectations and needs regarding a tea maker and service related products. The analysis of ERM sessions will lead to emerging themes and potential design solution areas.

Initial design exploration (individual): The students will develop initial ideas through the MATRIX and scenario building exercise to explore diverse design solutions.

Preliminary evaluation: Each student will present alternative design solutions with full scale mock-ups.

User testing and design detailing: The students will focus on a design solution, conduct user testing, and further develop their designs.

Final evaluation: The students will finalize the design solution in detail, and prepare the final presentation for evaluation. The final presentation will include 2D presentation boards and a 3D full-scale white model reflecting the important product features.

Grading:
Literature search and user observation (team work) 7.5%
ERM session and presentation (team work) 10%
Matrix (individual) 7.5%
Scenario 5%
Preliminary Jury 15%
User testing 5%
Design details and technical drawings 5%
Final Jury 40%

Sketch book Bonus 5%
Bound copy of all hand-drawn sketches as part of the project phases

Students should attend no less than %80 of the studio hours, and should participate in %80 of all the graded activities throughout a semester. According to the new regulations student performance will be graded as NA (not attended) if they fail to comply with attendance and participation requirements. Resit exams will not be given to the students with an NA grade.Medical reports are valid only for preliminary and final juries.

APPENDIX S

THE ERM BRIEF OF THE ENGAGING AND SUSTAINABLE DESIGN SOLUTIONS FOR TEA MAKING AND SERVING EXPERIENCE

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2012-13 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Mustafa Hasdoğan, Part-time Inst. Dr. Harun Kaygan, Res. Asst. Koray Benli, Res. Asst. M. Erdi Özgürlük,

Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

Term Project: Engaging and Sustainable Design Solutions for Tea Making and Serving Experience

Experience Reflection Modeling (ERM)

Rehearsal of session: 5 March 2013, Tuesday 13:40-17:30

ERM sessions: 7-8 March, Thursday and Friday

Analysis Part I Presentation: 12 March, Tuesday 13:40

Submission of insights (digital and hardcopy, 12 March, Tuesday 13:40)

Submission design solution areas (hardcopy submission, 15 March, Friday 8:40)

Analysis Part II Presentation: 15 March, Friday 16:00

1. Introduction

The aim of this exercise is to conduct exploratory and generative Experience Reflection Modeling (ERM) sessions with the participants that teams met during the user observation phase. The ERM will be used as a design research method which helps users express and externalize their needs, experiences, preferences and expectations related to the tea making and serving. The ERM sessions will help you understand how to incorporate local values, what the usage patterns and rituals are, how to encourage product maintenance and product part replacement, what the resource consumption patterns are, and how to communicate the process of tea making.

As a method the ERM brings together 3D modeling, interview, video recording, analysis and sketching techniques. In an ERM session the researcher asks questions to the participant by using an interview schedule, and in response to that the participant expresses her/his thoughts aloud, and builds a 3D model of particular products by using a toolkit provided.

This exercise will consist of the following phases:

- Introduction and presentation of the ERM method by the tutors
- Preparing the ERM toolkit
- Arranging the participants
- Rehearsal of the ERM session to get familiar with the questions in the interview schedule and the toolkit
- Setting up the ERM environment (arranging the room and the devices to be used)

- Conducting the ERM sessions with the participants
- Analysis part I: Preparation of a video presentation (e.g. *.wmv) based on the selected videos, and development and submission of insights and design solution areas from the ERM session
- Analysis part II: Preparation and presentation of a poster identifying potential solution areas with initial ideas through quick sketching

2. The ERM toolkit

The ERM toolkit includes simple and abstract 2D and 3D forms representing various potential components of an electric tea maker and its serving set such as tea pot, handle, filter, base, spout, tea glass and saucer, etc. (see Figure S.1). The components of the toolkit are brought together by putty-like adhesives such as Blue-tack or Tack-it. The toolkit also includes different materials such as colored pens and pencils, paper tape, cord, wire, play-dough, colored papers, aluminum foil, fabrics, etc. to tailor the model to the specific requests or needs of the participants. The vectorial drawings of the toolkit developed by Senem Turhan will be provided (see the file toolkit_tea_maker.3dm), and each team will produce its own toolkit in the Faculty workshops. If desired, the teams may add new elements to the toolkit.

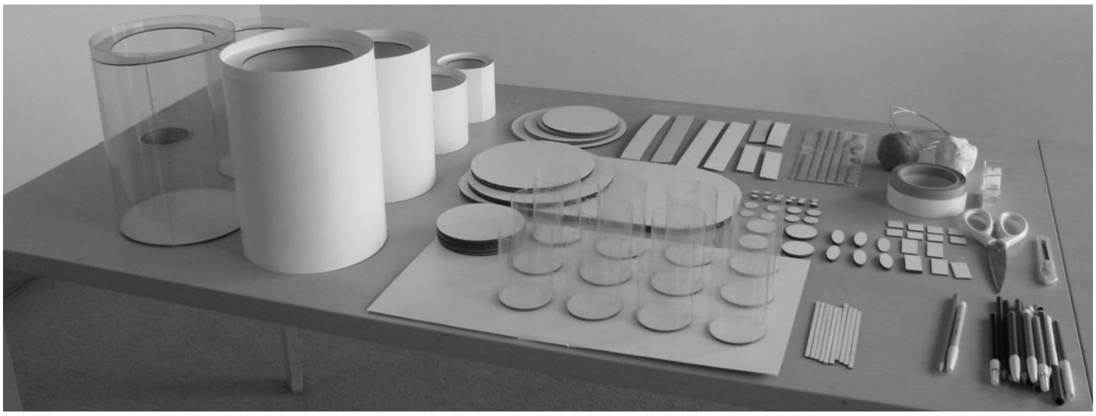


Figure S.1 The ERM toolkit

3. Analysis of ERM Sessions

The analysis of the ERM sessions will help you highlight the interesting and insightful statements made by the participants, and identify the potential solution areas. To present the results of your analysis use the formats provided.

Analysis part I:

Analyze the video recordings as described below and prepare a presentation:

- Select 10-12 video sections considering the three main project design considerations (i.e. incorporating local values, usage patterns and rituals; encouraging product maintenance and product part replacement; understanding resource consumption patterns and communicating the process of tea brewing) that you find important from the video recording of the ERM session;
- Present these video sections with English subtitles (for the sessions conducted in Turkish);
- Develop and provide insights that are the <u>interpretations</u> of the participants' statements in the video sections;
- Presentation format: 20 min. Video presentation; language: English (see Figure S.2).

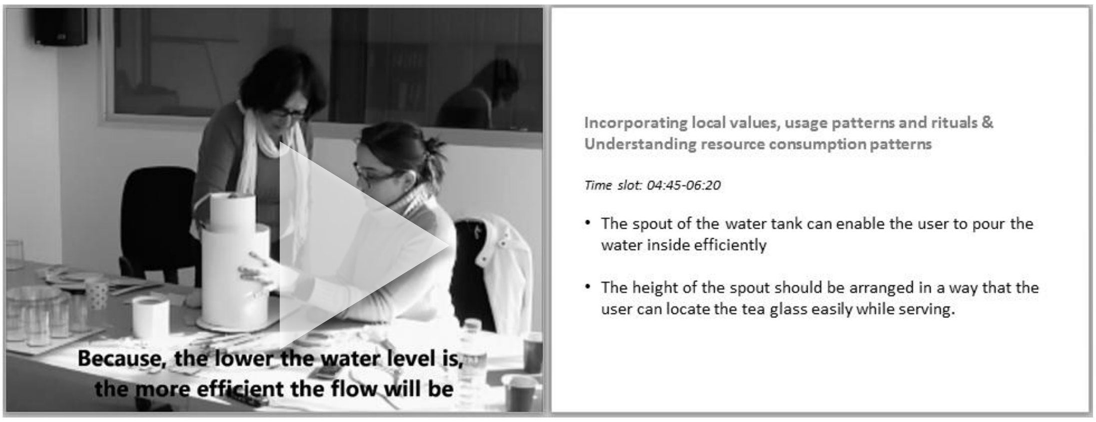


Figure S.2 Sample video snapshots

- Submission of insights and design solution areas (DSAs) (see Figure S.3 & Figure S.4)

Video Presentation

12 March, Tuesday 13:40; format: video file

Your presentation will include the following:

- user information (i.e. age, gender, occupation, year of experience with the product)
- the images of the electrical tea maker and the serving set that the participant actually uses,
- the images of the electrical tea maker and the serving set that the participant has modeled or developed during the ERM session,
- selected video sections with English subtitles along with your insights related with the corresponding video sections.

Submission of insights

Digital and hard copy submission on Tuesday, March 12th at 13:40; format A4 Portrait

Compile and upload your insights with corresponding images from the session (see Fig. 3) based on the format provided (see METU_ID302_Spring2013_TeaMakingServing_analysisPartI. docx file).

Female, 51, Retired, 5 years' experience		Incorporating local values, usage patterns and rituals Team : G Time slot: 17:05
	Controls and displays can give sensorial feedback for informing the user during the brewing process.	

Figure S.3 A snapshot from the sample Word document

Submission of design solution areas (DSA)

Hard copy submission on Friday, March 15th at 8:40; format: A4 Portrait

Write down your potential design solution areas based on the insights (see Fig. 4).

Female, 51, Retired, 5 years' experience		Incorporating local values, usage patterns and rituals Team : G Time slot: 17:05
	Controls and displays can give sensorial feedback for informing the user during the brewing process.	Speaking teapot Friendly feedback Assistive tea maker Personalized feedback Master of taste

Figure S.4 A snapshot from the sample including design solution areas

Analysis part II:

Compile the design solution areas and prepare a presentation board:

- Arrange your design solution areas under the three main sustainable design considerations on your analysis poster. Some solution areas might be related to more than one design consideration.
- Present your initial ideas through quick sketching in relation to the design considerations as exemplified in the sample format.
- Presentation format: 100X140 cm paper board; orientation: portrait; language: English

Presentation board

Hard copy submission on Friday at 16:00; format: 100x140 Portrait

The presentation board will include the following:

- categorization of the potential solution areas under the three main project considerations, and initial sketches (see Figure S.5).

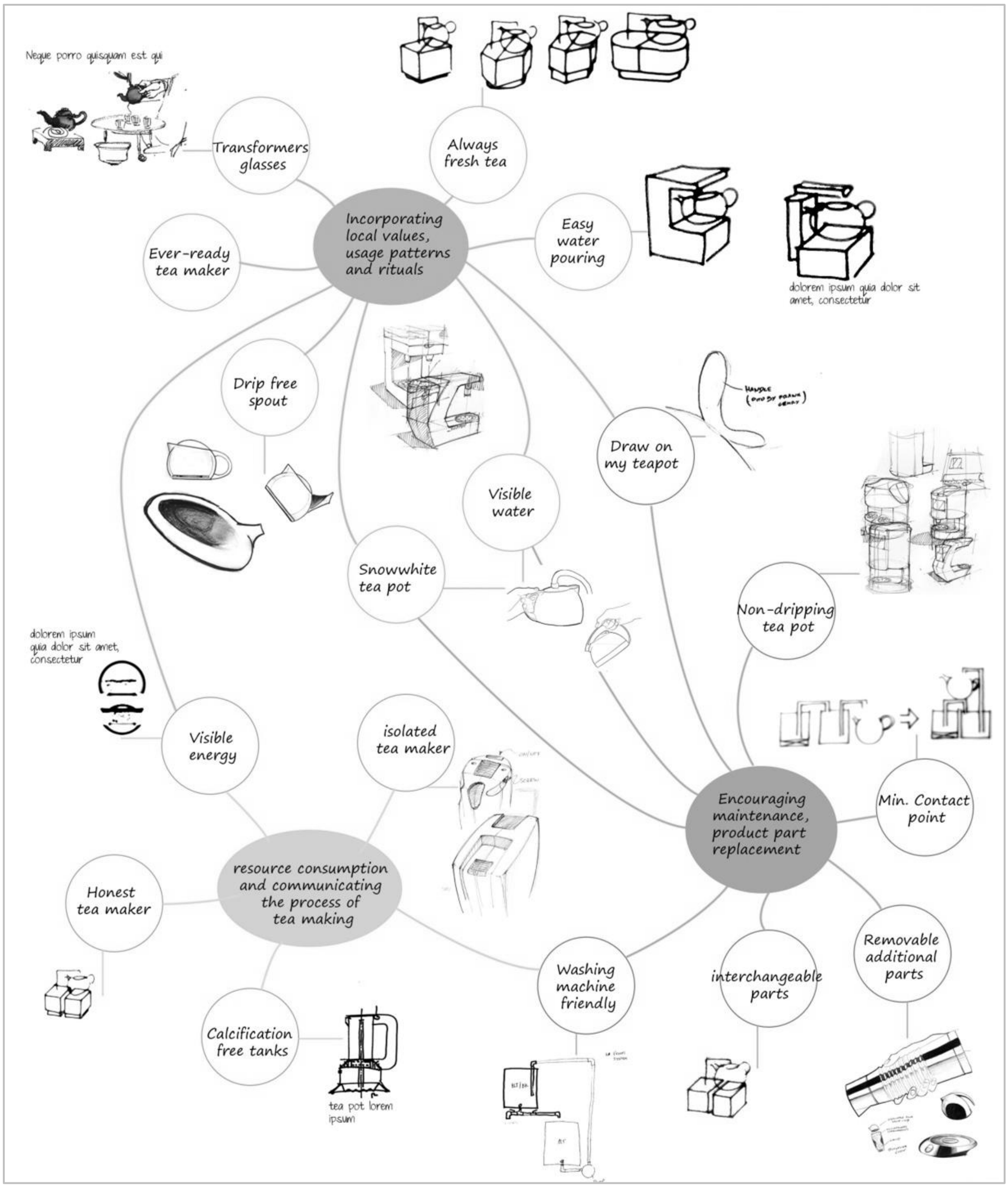


Figure S.5 Sample presentation board

The sketches in the sample presentation board II were taken from the following sources:

Eskild Tjalve, 1979. A short course in industrial design. London: Butterworths.

http://mauritania-isabel.blogspot.com/2009/02/drinking-tea-with-moors.html

http://www.patrickhartog.com/2010/01/quick-sketches-coffee-machines/

http://ryecrowendesign.blogspot.com/2011_09_01_archive.html

http://psuedo-guru.deviantart.com/art/Kettle-Sketches-44467677

http://www.homebrewtalk.com/f51/two-kettle-system-182435/

APPENDIX T

THE QUESTIONNAIRE USED FOR THE THIRD FIELD STUDY

T.1 TURKISH

Ad, Soyad:

Ekip:

Ekte sunulan anket ODTÜ, Endüstri Ürünleri Tasarımı Bölümü'nde yürütülmekte olan bir doktora çalışması kapsamında hazırlanmıştır. Verdiğiniz cevaplar sadece akademik amaçlı çalışmalarda kullanılacaktır. Vereceğiniz bilgiler doğru ya da yanlış olarak değerlendirilmeyeceğinden, size en uygun gelen seçenekleri işaretlemeniz çalışmanın başarısı açısından önemlidir. Teşekkürler.

Senem Turhan

Aşağıdaki verilen her bir ifadede size uygun gelen şeçeneği işaretleyiniz.

		1	2	3	4	5
		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
1	En başta yapılan sunum ERM süreçlerini anlamamı sağladı	☐	☐	☐	☐	☐
2	ERM süreçlerini anlatan metin (brief) ERM süreçlerini açıkladı	☐	☐	☐	☐	☐
3	ERM oturumunda iş bölümünün nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
4	Sunumda gösterilen pilot çalışmaya ait video örnekleri ERM oturumunu anlamama yardımcı oldu	☐	☐	☐	☐	☐
5	ERM oturumu için provanın nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
6	ERM oturumu için planlanan prova süresi fazlaydı	☐	☐	☐	☐	☐
7	Görüşme kılavuzundaki sorular ürünün kullanım süreçlerini anlamama yardımcı oldu	☐	☐	☐	☐	☐

		1	2	3	4	5
		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
8	Görüşme kılavuzunun başında yer alan katılımcıyı bilgilendirme bölümü uzundu	☐	☐	☐	☐	☐
9	Görüşme kılavuzu, soruların takip edilebilmesine olanak verdi	☐	☐	☐	☐	☐
10	Görüşme kılavuzu yeni sorular eklemeyebilmemize olanak verdi	☐	☐	☐	☐	☐
11	Görüşme kılavuzu, katılımcıyı hangi aşamalarda modele yönlendireceğimiz konusunda açıktı	☐	☐	☐	☐	☐
12	Modelleme setinin oturumda nasıl kullanılacağı açıktı	☐	☐	☐	☐	☐
13	Modelleme seti için verilen çizim dosyası seti hazırlamak için yeterliydi	☐	☐	☐	☐	☐
14	Modelleme setindeki malzemeler ve parçalar, katılımcının söylediklerini model üzerinde yansıtması için yeterliydi	☐	☐	☐	☐	☐
15	Parçaları birleştirmek için kullanılan Tack-it ürünü yeterliydi	☐	☐	☐	☐	☐
16	Modelleme seti yeni malzemeler ekleyebilmemize olanak verdi	☐	☐	☐	☐	☐
17	Modelleme setini hazırlama süresi fazlaydı	☐	☐	☐	☐	☐
18	ERM oturumunda, modelleme setinin masa üzerindeki yerleşimi uygundu	☐	☐	☐	☐	☐
19	Modelleme setinin soyut ve basit parçalardan oluşması katılımcımızın aktif katılımını destekledi	☐	☐	☐	☐	☐
20	ERM oturumunda, modelleme sürecinin masa başında oturularak yapılması uygundu	☐	☐	☐	☐	☐
55R	Önceden ERM oturumu hakkında bilgi verilmesi katılımcımızın aktif katılımını destekledi	☐	☐	☐	☐	☐
21	ERM oturumu için ÜTEST ortamı uygundu	☐	☐	☐	☐	☐
22	ERM oturumunda ÜTEST ortamı katılımcının aktif katılımını destekledi	☐	☐	☐	☐	☐
23	Oturumların ÜTEST ortamında yapılması odaklanmamı sağladı	☐	☐	☐	☐	☐
24	Video kameranın yerleşimi üç boyutlu modelleme sürecini kaydetmek için uygundu	☐	☐	☐	☐	☐
25	Oturumda çektiğimiz fotoğraflar modelleme sürecini aktarmak için yeterliydi	☐	☐	☐	☐	☐
26R	Sunum sırasında verilen örnekler ve açıklamalar analizin birinci bölümünü anlamamı sağladı	☐	☐	☐	☐	☐
27	Verilen örnek poster ERM analizinin ikinci aşamasını anlamamı sağladı	☐	☐	☐	☐	☐

		1	2	3	4	5
		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
28	ERM analizinde, çıkarımların nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
29	ERM analizinde, tasarım çözüm alanlarının nasıl geliştirileceği açıktı	☐	☐	☐	☐	☐
30	ERM analizindeki üç kategori (proje ölçütleri) açıktı	☐	☐	☐	☐	☐
62N	ERM analizinde, video sunumunun nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
32	ERM analizinde, skeçlerin nasıl yapılacağı açıktı	☐	☐	☐	☐	☐
33R	Birinci aşamadaki sunumların video ağırlıklı olması analiz sürecini destekledi	☐	☐	☐	☐	☐
35	Seçtiğimiz alıntı sayısı azdı	☐	☐	☐	☐	☐
36R	Analiz sürecinde katılımcının söylediklerini videodan izlemek onu anlamamıza yardımcı oldu	☐	☐	☐	☐	☐
63N	Video sunumu için seçtiğimiz bölümlerin uzunluğu videodaki ana fikri anlamak için yeterliydi	☐	☐	☐	☐	☐
38	Tasarım çözüm alanlarımız verilen kategoriler (proje ölçütleri) ile ilişkiliydi	☐	☐	☐	☐	☐
39	Birden fazla kategoriye ait çözüm alanlarımızı analiz posterine yerleştirirken zorlandık	☐	☐	☐	☐	☐
40	Birden fazla çözüm alanına ait skeçleri analiz posterine yerleştirirken zorlandık	☐	☐	☐	☐	☐
41	ERM oturumu, analiz posterinde fikir geliştirmemi destekledi	☐	☐	☐	☐	☐
42R	Video sunumları, analiz posterinde fikir geliştirmemi destekledi	☐	☐	☐	☐	☐
43	Çıkarımlar, analiz posterinde fikir geliştirmemi destekledi	☐	☐	☐	☐	☐
44	Tasarım çözüm alanları, analiz posterinde fikir geliştirmemi destekledi	☐	☐	☐	☐	☐
46	Örnek analiz posteri, kendi özgün posterimizi oluşturmamıza olanak verdi	☐	☐	☐	☐	☐
47	Analiz sürecine kendi bilgi ve deneyimlerimizi yansıttık	☐	☐	☐	☐	☐
48	Analiz süresince katılımcının oturumda getirdiği önerilere bağlı kaldık	☐	☐	☐	☐	☐
49	Analizin birinci aşaması için verilen süre fazlaydı	☐	☐	☐	☐	☐
51R	Diğer ekiplerin video sunumlarından yararlandım	☐	☐	☐	☐	☐
64N	Diğer ekiplerin çıkarım ve tasarım çözüm alanlarından yararlandım	☐	☐	☐	☐	☐

		1	2	3	4	5
		Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
52	Diğer ekiplerin analiz posterlerinden yararlandım	☐	☐	☐	☐	☐
65N	Diğer ekiplerin video sunumlarını izlemek fikir geliştirme sürecimi destekledi	☐	☐	☐	☐	☐
50R	Diğer ekiplerin analiz posterlerinin stüdyoda asılarak paylaşılması fikir geliştirme sürecimi destekledi	☐	☐	☐	☐	☐
53	ERM süreci, Matrix egzersizini destekledi	☐	☐	☐	☐	☐
56R	ERM'e geçmeden önce çay makinesi hakkındaki teknik bilginin verilmesi fikir geliştirme sürecimi destekledi	☐	☐	☐	☐	☐
57R	Video sunumunda katılımcının kullandığı ürünle ile ilgili daha detaylı bilgi verilmesini isterdim	☐	☐	☐	☐	☐
58	ERM analizlerinde diğer ekiplerle fikir alışverişi yapmak isterdim	☐	☐	☐	☐	☐
59	Analiz posterini hazırlama süresi için daha fazla zaman ayrılmasını isterdim	☐	☐	☐	☐	☐
61	Diğer ekiplerin analiz posterlerini sunması için daha fazla sürenin ayrılmasını isterdim	☐	☐	☐	☐	☐

APPENDIX T

THE QUESTIONNAIRE USED FOR THE THIRD FIELD RESEARCH

T.2 ENGLISH

Name:

Team:

This questionnaire was prepared within the Ph.D. thesis study conducted at the Department of Industrial Design, METU. Answers will only be used for academic purposes and your name will not be mentioned for any purpose in the final study. Your answers will not be assessed whether true or false. Thank you for your time and consideration.

Senem Turhan

For each statement, please check the one answer that fits you best.

		1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	The presentation at the beginning helped me understand the ERM phases.	☐	☐	☐	☐	☐
2	The brief describing the ERM phases was clear.	☐	☐	☐	☐	☐
3	How to make the division of labour at the ERM session was clear.	☐	☐	☐	☐	☐
4	The selected videos from the pilot study helped me understand the ERM session.	☐	☐	☐	☐	☐
5	How to rehearse for the ERM session was clear.	☐	☐	☐	☐	☐
6	The time period dedicated for the rehearsal was long.	☐	☐	☐	☐	☐
7	The questions in the interview schedule helped me understand the use phases of a tea maker.	☐	☐	☐	☐	☐
8	Introduction parts at the beginning of the interview schedule which informed the participant about the study was long.	☐	☐	☐	☐	☐

		1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9	The interview schedule enabled us to follow the questions.	☐	☐	☐	☐	☐
10	The interview schedule enabled us to add new questions.	☐	☐	☐	☐	☐
11	The interview schedule was clear about in which the phases we led the participant to the 3D modelling.	☐	☐	☐	☐	☐
12	How to use the ERM toolkit in the session was clear.	☐	☐	☐	☐	☐
13	The drawing file (toolkit_tea_maker.3dm) for the ERM toolkit was adequate for the preparation of the toolkit.	☐	☐	☐	☐	☐
14	The parts and materials in the ERM toolkit were adequate for the participant to reflect her/his responses on the 3D model.	☐	☐	☐	☐	☐
15	Tack-it was an adequate tool to connect parts in the toolkit.	☐	☐	☐	☐	☐
16	The ERM toolkit enabled us to add new materials and parts.	☐	☐	☐	☐	☐
17	The time period dedicated to the preparation of the toolkit was long.	☐	☐	☐	☐	☐
18	The arrangement of the toolkit on the table was adequate at the ERM session.	☐	☐	☐	☐	☐
19	Abstract and basic parts in the toolkit supported the active involvement of our participant.	☐	☐	☐	☐	☐
20	Conducting the 3D modelling process by sitting close to the ERM toolkit was adequate at the ERM session.	☐	☐	☐	☐	☐
55R	Giving information to the participant about the ERM beforehand supported her/his active involvement	☐	☐	☐	☐	☐
21	UTEST environment for the ERM session was adequate.	☐	☐	☐	☐	☐
22	UTEST environment supported the active involvement of the participant at the ERM session.	☐	☐	☐	☐	☐
23	Conducting the ERM session at UTEST enabled us to concentrate.	☐	☐	☐	☐	☐
24	The location of the camera was adequate for recording the 3D modelling process.	☐	☐	☐	☐	☐
25	The pictures that we took during the ERM session were adequate to convey the 3D modelling process.	☐	☐	☐	☐	☐
26R	Examples and information given during the presentation enabled me to understand the first part of the ERM analysis	☐	☐	☐	☐	☐
27	Provided sample poster enabled me to understand the second part of the analysis phase.	☐	☐	☐	☐	☐

		1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
28	How to gain insights from the participant's statements for the first poster during the ERM analysis phase was clear.	☐	☐	☐	☐	☐
29	How to develop design solution areas at the ERM analysis was clear.	☐	☐	☐	☐	☐
30	Three categories (design considerations) given for the ERM analysis were clear.	☐	☐	☐	☐	☐
62N	How to prepare the video presentation at the ERM analysis was clear.	☐	☐	☐	☐	☐
32	How to sketch at the ERM analysis phase was clear.	☐	☐	☐	☐	☐
33R	Video-based presentations at the first part supported the ERM analysis phase.	☐	☐	☐	☐	☐
35	The number of selected quotes for the first poster was few.	☐	☐	☐	☐	☐
36R	Watching videos of the participant's responses enabled us to understand her/him.	☐	☐	☐	☐	☐
63N	The length of the video clips was adequate to understand the subject matter of the clip.	☐	☐	☐	☐	☐
38	Our design solution areas were related with the given categories (design considerations).	☐	☐	☐	☐	☐
39	We had difficulty in placing the design solution areas related with more than one category on the analysis poster.	☐	☐	☐	☐	☐
40	We had difficulty in locating the sketches related with more than one design solution areas on the analysis poster.	☐	☐	☐	☐	☐
41	The ERM session supported my idea generation at the analysis poster.	☐	☐	☐	☐	☐
42R	The video presentations supported my idea generation at the analysis poster.	☐	☐	☐	☐	☐
43	The insights supported my idea generation at the analysis poster.	☐	☐	☐	☐	☐
44	The design solution areas supported my idea generation at the analysis poster.	☐	☐	☐	☐	☐
46	The sample poster enabled us to develop/modify/create our unique poster.	☐	☐	☐	☐	☐
47	We incorporated our knowledge and skills into the ERM analysis.	☐	☐	☐	☐	☐
48	During the ERM analysis, we only took into consideration the participant's solutions that she generated at the ERM session.	☐	☐	☐	☐	☐
49	The time period dedicated to the first part of the ERM analysis was long.	☐	☐	☐	☐	☐

		1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
51R	I benefitted from other teams' video presentations.	☐	☐	☐	☐	☐
64N	I benefitted from other teams' insights and design solution areas.	☐	☐	☐	☐	☐
52	I benefitted from other teams' analysis posters.	☐	☐	☐	☐	☐
65N	Watching other teams' video presentations supported my idea generation phase.	☐	☐	☐	☐	☐
50R	Hanging other teams' posters on the boards at the studio supported my idea generation phase.	☐	☐	☐	☐	☐
53	The ERM method supported the Matrix exercise.	☐	☐	☐	☐	☐
56R	Providing technical information about a tea maker before the ERM supported my idea generation phase.	☐	☐	☐	☐	☐
57R	I wish more detailed information about the product that the participant used would be given at video presentations.	☐	☐	☐	☐	☐
58	I wish I would exchange ideas with other teams during the ERM analysis.	☐	☐	☐	☐	☐
59	I wish the time period dedicated to the analysis poster would be much more.	☐	☐	☐	☐	☐
61	I wish the time period dedicated to the presentation of other teams' posters would be much more.	☐	☐	☐	☐	☐

APPENDIX U

THE RELIABILITY STATICS OF THE QUESTIONNAIRE

Case Processing Summary

		N	%
Cases	Valid	28	96,6
	Excluded[a]	1	3,4
	Total	29	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,832	59

```
DESCRIPTIVES VARIABLES=Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13
Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q55R Q21 Q22 Q23 Q24 Q25 Q26R Q27 Q28
Q29 Q30 Q62N Q32 Q33R Q35 Q36R Q63N Q38 Q39 Q40 Q41 Q42R Q43 Q44 Q46
Q47 Q48 Q49 Q51R Q64N Q52 Q65N Q50R Q53 Q56R Q57R Q58

Q59 Q61

  /STATISTICS=MEAN STDDEV.
```

APPENDIX V

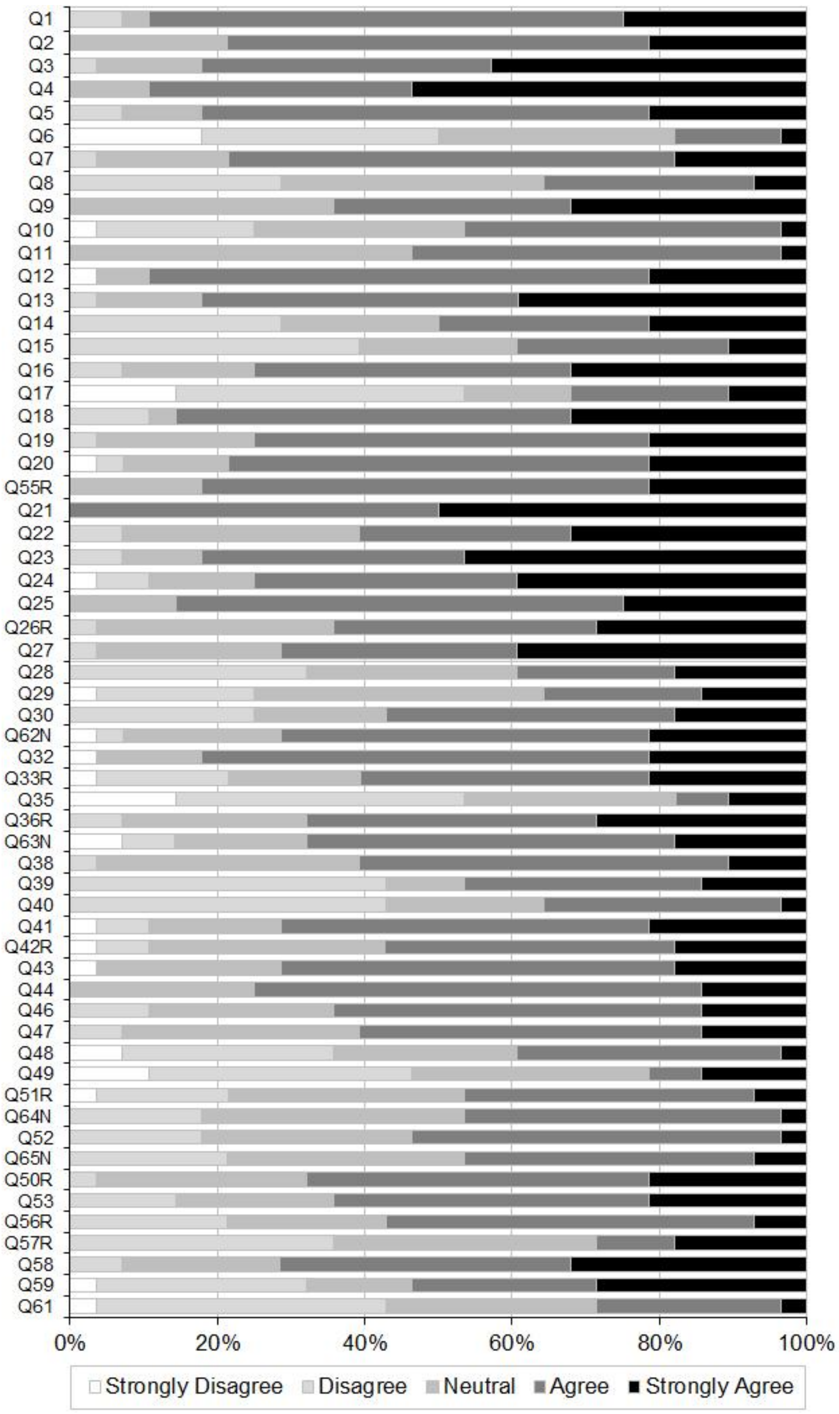
THE DESCRIPTIVE STATICS OF THE QUESTIONNAIRE

	N	Mean	Std. Deviation
Q1	28	4,07	,766
Q2	28	4,00	,667
Q3	28	4,21	,833
Q4	28	4,43	,690
Q5	28	3,96	,793
Q6	28	2,54	1,071
Q7	28	3,93	,716
Q8	28	3,14	,932
Q9	28	3,96	,838
Q10	28	3,21	,957
Q11	28	3,57	,573
Q12	28	4,04	,793
Q13	28	4,18	,819
Q14	28	3,43	1,136
Q15	28	3,11	1,066
Q16	28	4,00	,903
Q17	28	2,75	1,266
Q18	28	4,07	,900
Q19	28	3,93	,766
Q20	28	3,89	,916
Q55R	28	4,04	,637
Q21	28	4,50	,509
Q22	28	3,86	,970
Q23	28	4,21	,917
Q24	28	4,00	1,089
Q25	28	4,11	,629
Q26R	28	3,89	,875
Q27	28	4,07	,900
Q28	28	3,25	1,110
Q29	28	3,21	1,067
Q30	28	3,50	1,072
Q62N	28	3,82	,945

	N	Mean	Std. Deviation
Q32	28	3,96	,838
Q33R	28	3,57	1,136
Q35	28	2,61	1,166
Q36R	28	3,89	,916
Q63N	28	3,64	1,096
Q38	28	3,68	,723
Q39	28	3,18	1,156
Q40	28	2,96	,962
Q41	28	3,79	,995
Q42R	28	3,61	,994
Q43	28	3,82	,863
Q44	28	3,89	,629
Q46	28	3,68	,863
Q47	28	3,68	,819
Q48	28	3,00	1,054
Q49	28	2,79	1,197
Q51R	28	3,29	,976
Q64N	28	3,32	,819
Q52	28	3,39	,832
Q65N	28	3,32	,905
Q50R	28	3,86	,803
Q53	28	3,71	,976
Q56R	28	3,43	,920
Q57R	28	3,11	1,100
Q58	28	3,96	,922
Q59	28	3,46	1,290
Q61	28	2,86	,970
Valid N (listwise)	28		

APPENDIX W

THE CENTRAL TENDENCY GRAPH OF ALL ITEMS IN THE QUESTIONNAIRE



APPENDIX X

THE INTERVIEW SCHEDULE FOR THE THIRD FIELD STUDY

X.1 TURKISH

Ekip:

Tarih:

Süre:

1. Provaların nasıl yapılacağı ne derece açıktı?
2. Provalar için ayrılan süreyi nasıl değerlendirirsiniz?
3. ERM kılavuzunun başındaki katılımcıyı bilgilendirme bölümünü nasıl değerlendirirsiniz?
4. Görüşme kılavuzu, soruların takip edilebilmesine ne derece olanak verdi?
5. Önceden ERM oturumu hakkında bilgi verilmesi katılımcımızın aktif katılımını ne derece destekledi?
6. Modelleme seti için verilen çizim dosyası seti hazırlamak için ne derece yeterliydi?
7. Modelleme setini hazırlama süresini nasıl değerlendirirsiniz?
8. Analizin birinci bölümü ne derece açıktı?
9. ERM analizinde, video sunumunun nasıl yapılacağı ne derece açıktı?
10. Analizin birinci aşamasındaki sunumların video ağırlıklı olmasını nasıl değerlendirirsiniz?
11. Video sunumlarındaki kliplerin uzunluklarını nasıl değerlendirirsiniz?
12. Video sunumlarını nasıl değerlendirirsiniz?
13. Video sunumlarında katılımcının kullandığı ürünle ilgili daha detaylı bilgi almak ister miydiniz?
14. Diğer ekiplerin katılımcılarının videolarını izlemek ne derece etkiliydi?
15. Diğer ekiplerin video sunumlarından ne derece yararlandınız?
16. Diğer ekiplerin çıkarım ve tasarım çözüm alanlarından ne derece yaralandınız?
17. Analiz süresince diğer ekiplerle fikir alışverişi yapmayı ne derece isterdiniz?
18. Analiz posteri için ayrılan süreyi nasıl değerlendirirsiniz?
19. Diğer ekiplerin video sunumları fikir geliştirme sürecinizi nasıl etkiledi?
20. Diğer ekiplerin analiz posterlerinin stüdyoda asılması fikir geliştirme sürecinizi nasıl etkiledi?
21. DYM fikir geliştirme sürecinizi ne derece destekledi?
22. DYM’den önce çay makinesi hakkında teknik bilgi verilmesini nasıl değerlendirirsiniz?

APPENDIX X

THE INTERVIEW SCHEDULE FOR THE THIRD FIELD RESEARCH

X.2 ENGLISH

Team:

Date:

Duration:

1. Was it clear how to rehearse for the ERM session?

2. How do you assess the time period dedicated for the rehearsal?

3. Could you assess the introduction part at the beginning of the interview schedule informing the participant about the study?

4. To what extent did the interview schedule enable you to follow questions?

5. Could you assess giving information to the participant about the ERM beforehand?

6. To what extent was the drawing file for the toolkit adequate for the toolkit preparation?

7. How do you assess the time period dedicated for the toolkit preparation?

8. To what extent is the first part of the ERM analysis clear?

9. To what extent is the preparation of the video presentation clear?

10. Could you assess video-based presentations at the first part of the analysis?

11. Could you assess the length of the video clips in the video presentation?

12. Could you assess the video presentations?

13. Would you like to have more detailed information about the product that the participant used at video presentations?

14. To what extent was watching videos of the participant’s responses beneficial?

15. To what extent did you benefit from other team's video presentations?

16. To what extent did you benefit from other team's insights and design solution areas?

17. Would you like to exchange ideas with other teams during the ERM analysis?

18. Would you like more time period dedicated to the analysis poster?

19. To what extent did other teams' video presentations support your idea generation phase?

20. To what extent did hanging other teams’ posters on the boards at the studio support your idea generation phase?

21. To what extent did the ERM support the Matrix exercise?

22. Could you assess providing technical information about a tea maker before the ERM?

APPENDIX Y

THE INFORMATIVE NOTE TO THE PARTICIPANT

Y.1 TURKISH

Deneyim Yansıtma Modellemesi

Deneyim Yansıtma Modellemesi , kullanıcıların belli bir ürün ile ilgili yaşadıkları deneyimleri, görüşlerini ve tercihlerini ifade etmeleri için kurgulanmış özel bir yöntemdir. Bir yandan bizim yönelttiğimiz soruları yanıtlarken bir yandan da size sağlanan setin elemanlarını kullanarak söz konusu ürünün üç boyutlu fiziksel bir modelini oluşturacaksınız. Bu fiziksel model, sizin ürünle ilgili deneyimlerinizi hatırlamanıza ve tercihlerinizi somut olarak ifade etmenize yardımcı olacak.

Figure Y.1 Snapshots from the ERM sessions

Oturum sırasında size hazır bazı parçalar sunacağız. Bu parçalarla bir elektrikli çay makinesi ve çay servisi elemanlarını oluşturacağız. Bunları oluştururken ayrıntıları hatırlamanızı kolaylaştırmak için bir çay demleme ve sunma sürecini yaşıyormuş gibi yapacağız. Oluşturacağımız modellerin sizin kullandığınız çay makinesi ve servis elemanları olmasını beklemiyoruz, kendi ihtiyaçlarınıza ve beklentilerinize göre yeni ve farklı ürünler oluşturabilirsiniz.

Elektrikli çay makinesi ve servis elemanlarını oluştururken önerilen parçaları doğrudan kullanabilirsiniz. İsterseniz kalem ve makas yardımı ile bu parçalar üzerinde değişiklikler de yapabilirsiniz. Önerilen parçalar dışında başka bir parça da önerebilirsiniz. Önerdiğiniz bu farklı parçaları oyun hamuru ile oluşturabiliriz. Bu süreç boyunca istediğiniz zaman biz de size yardımcı olacağız.

Elektrikli çay makinesinin ve servis elemanlarının parçalarını bir araya getirirken sizin tercih ve önerilerinizi anlamak istiyoruz. Bu nedenle aklınızdan geçenleri yüksek sesle söylemeniz sizi daha iyi anlamamıza yardımcı olacak. Oluşturduğunuz modellerde herhangi bir aşamada değiştirmek istediğiniz şeyler olursa değiştirebilirsiniz ya da bizden değiştirmemizi isteyebilirsiniz.

Bu araştırma, ODTÜ Endüstri Ürünleri Tasarımı Bölümü üçüncü yıl tasarım dersi ve Araş. Gör. Senem Turhan'ın doktora tez çalışması kapsamında yapılmaktadır.Araştırmaya katkıda bulunduğunuz için teşekkür ederiz.

APPENDIX Y

THE INFORMATIVE NOTE TO THE PARTICIPANT

Y.2 ENGLISH

Experience Reflection Modelling (ERM)

The ERM is a design research method which helps users to reflect on their needs, experiences, preferences and expectations regarding a product. During the session we ask questions to you by using the ERM schedule provided. In response to that you express your thoughts as you build a three dimensional model of an electric tea maker and its serving set by using the tool kit provided. This process helps you to recall your experiences about the product and to reflect on your preferences and needs related to the product.

Figure Y.2 Snapshots from the ERM sessions (English)

We will provide you with some ready-made parts and you will build an electric tea maker and its serving set by using these parts. In order to remember the details about tea brewing and serving processes, we will pretend we brew and serve tea while building the model. Your model does not have to look like your own electrical tea maker or your tea serving set, you may build new ones in accordance with your needs and expectations.

While making your model, you can use the parts provided. If you like, we can make changes on these parts with the help of scissors and pens. You can propose different parts rather than the ones provided. You can create new parts by using playdough. We can assist you during this session whenever you ask for it.

We would like to understand your preferences and suggestions while you bring together the components of the tea maker and its serving set. Thus, “thinking aloud” and sharing your thoughts with us will help us to understand your perspective better. You can make any changes on the model at any time during the session or ask for assistance to make changes.

This research will be conducted in the context of a third year undergraduate course and the doctoral study of Res. Asst. Senem Turhan at the Department of Industrial Design, METU. Thank you very much for your participation. We really appreciate your contribution to our research.

APPENDIX Z

THE ERM INTERVIEW SCHEDULE FOR ENGAGING AND SUSTAINABLE DESIGN SOLUTIONS FOR TEA MAKING AND SERVING EXPERIENCE PROJECT

Z.1 TURKISH

Middle East Technical University Faculty of Architecture
Department of Industrial Design Spring 2012-13 ID 302 Industrial Design IV
Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Mustafa Hasdoğan, Part-time Inst. Dr. Harun Kaygan, Res. Asst. Koray Benli, Res. Asst. M. Erdi Özgürlük, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

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Term Project: Engaging and Sustainable Design Solutions for Tea Making and Serving Experience

Deneyim Yansıtma Modellemesi, DYM (*Experience Reflection Modeling, ERM)*

Görüşme Kılavuzu

Araştırmacıya notlar
YM sürecinde dikkat edilmesi gereken noktalar: DYM, kullanıcıların belli bir ürün ile ilgili yaşadıkları deneyimleri, görüşlerini ve tercihlerini ifade etmeleri için kurgulanmış özel bir yöntemdir. Kullanıcılar bir yandan araştırmacının yönelttiği soruları yanıtlarken bir yandan da kendilerine sağlanan setin elemanlarını kullanarak söz konusu ürünün üç boyutlu fiziksel bir modelini oluştururlar. Bu fiziksel model, kullanıcının ürünle ilgili deneyimlerini hatırlamasına ve tercihlerini somut olarak ifade etmesine yardımcı olur. ERM süreci, araştırmacının sorularına verilen yanıtlarla ve elektrikli çay makinesi ve servis elemanlarının katılımcı tarafından basamak basamak oluşturulmasıyla ilerler. Katılımcının modeli oluştururken sürece aktif katılımı esastır. Katılımcının yaptığı tercihlerin nedenlerinin öğrenilmesi önemlidir. Bu kılavuz metninde <u>* ile işaretlenmiş</u> sorularda araştırmacı, setin parçalarını ve oluşturulan modeli kullanması için katılımcıyı özendirmeli; ayrıca katılımcının yanıtlarından veya yaptığı tercihlerden sonra katılımcıya “Neden bunu tercih ettiniz?” “Başka bir şey tercih eder misiniz?”gibi sorular yöneltmeli ve <u>tercihlerinin</u> <u>nedenlerini</u> öğrenmelidir. Parçaların seçimi, yerleştirilmesi ve gerekirse parçalar veya model üzerinde değişiklikler yapılması konusunda araştırmacı, eğer isterse katılımcıya yardımcı olabilir. DYM süreci ekip çalışması gerektirir; süreç boyunca en az bir kişinin video çekimiyle ilgilenmesi, bir kişinin oluşturulan fiziksel modelin sık sık fotoğrafını çekmesi, bir kişinin katılımcıya soruları yöneltmesi, bir kişinin de üç boyutlu modelleme sürecinde gerekli durumlarda katılımcıya destek olması önerilir. Katılımcınızı DYM oturumlarına davet ederken katılımcı bilgilendirme yazısını (METU_ID302_Spring2013_TeaMakingServing_info_p.docx) ve izin formunu (METU_ID302_Spring2013_TeaMakerServing_03_ERMConsentForm.docx) veriniz. Katılımcı oturuma gelmeden önce bilgilendirme yazısını okumuş olması beklenir. Okumaması durumunda oturum başlamadan önce kısaca siz süreci ona anlatabilirsiniz.

Görüşmemize başlamadan önce size yaptığımız araştırmayla ilgili biraz bilgi vermek istiyoruz. Bizler ODTÜ Endüstri Ürünleri Tasarımı Bölümünde üçüncü sınıf öğrencisiyiz. Benim adım ... görüşmeye katılan diğer arkadaşlarım da .... ve ... Bu araştırmayı tasarım dersi kapsamında sizin elektrikli çay makinesine ve çay servisi setine yönelik görüşlerinizi öğrenmek için yapıyoruz. Bu görüşmede toplanan veriler, eğitim amaçlı olarak tasarım sürecinde, Araş. Gör. Senem Turhan'ın doktora tez araştırmasında, bilimsel yayınlarda ve sunuşlarda kullanılacak. Görüşme sırasında anlattıklarınızı yalnızca bilimsel amaçlarla kullanacağız. Kimliğinizle ilgili bilgileri saklı tutacağız. Konuştuklarımızı daha sonra tam olarak hatırlayabilmek ve gözden geçirebilmek için görüşmemizi videoya kaydedeceğiz. Görüşmemiz bir saat kadar zaman alabilir. Görüşmeye başlamadan önce sormak istediğiniz herhangi bir şey var mı?

Başlamadan önce elektrikli çay makinenizi en sık kullandığınız bir senaryo seçelim. Bunlar "pazar kahvaltısı", "ofiste çay molası" ve "misafir ağırlama" gibi senaryolar olabilir. İsterseniz bu durumu canlandırarak çay yapalım ve servis edelim.

Hazırlık	1	*****Çay hazırlamaya başlamadan önce çay makinesinin temel parçalarına karar verelim. Örneğin su haznesi ve çay haznesi hangi büyüklükte olsun? Neden? Görünüşlerinin nasıl olmalarını tercih edersiniz? Neden? Bu parçaların nasıl yerleşmesini tercih edersiniz? Neden?
	2	Elektrikli çay makinesiyle çay yapmaya başlamadan önce ne gibi hazırlıklar yaparsınız?
	3	Elektrikli çay makinesini pirize yakın bir yere götürür müsünüz ya da yerini değiştirir misiniz?
	4	* Lütfen modele elektrik kablosunu yerleştirir misiniz?
	5	Seçtiğiniz senaryo için kaç kişilik çay demlemek istersiniz?
	6	Şimdi (…) kişilik çay hazırlama sürecini model üzerinden sırayla anlatır mısınız? [*Bundan sonraki soruların sırası katılımcının çay hazırlama sırasına göre değiştirilebilir.*]
	7	***** Su haznesindeki suyun miktarına nasıl karar verirsiniz?
	8	*Suyu nereden ve nasıl doldurursunuz?
	9	*Su haznesinin malzemesi ne olmalı? Neden?
	10	*Su haznesinin kulbu nasıl olmalı? Neden?
	11	* Su haznesinin kapağı nasıl olmalı? Neden?
	12	* Su çıkış ucu nasıl olmalı? Nasıl bir su çıkışı tercih edersiniz? Neden?
	13	* Çay makinesini ne zaman çalıştırırsınız? Nasıl çalıştırırsınız? *****Çay makinesini çalıştırdınız. Çay makinesinin çalıştığından nasıl emin olursunuz?
	14	*Çalıştığından emin olmak için farklı bir şey tercih eder miydiniz? Neden?
	15	*Su şu anda hazırlanıyor. Suyun hazır olduğunu nasıl anlarsınız?

Demleme	16	* Çayınızı nasıl demlersiniz?
	17	*Süzgeç kullanır mısınız? Nasıl bir süzgeç tercih edersiniz?
	18	*Çayın miktarını nasıl ayarlarsınız?
	19	*Çayı demlemek için kullandığınız suyun sıcaklığına nasıl karar verirsiniz?
	20	* Çayı demlemek için kullandığınız suyun miktarına nasıl karar verirsiniz?
	21	*Su haznesinin ve demliğin yerleşiminin nasıl olmasını tercih edersiniz?
	22	*Demliğin malzemesinin ne olmasını tercih edersiniz? Neden?
	23	*Demliğin kulbunun nasıl olmasını tercih edersiniz? Neden?
	24	*Kapağın nasıl olmasını tercih edersiniz? Neden?
	25	*Su çıkış ucunun nasıl olmasını tercih edersiniz? Neden?
	26	*Çayınız şu anda demleniyor. Demlenme sırasında ne sıklıkta, nasıl kontrol edersiniz?
	27	*Çayın hazır olduğunu nasıl anlarsınız? [*Görsel bir bilgiyle kontol ediliyor mu?*]
	28	Demleme süresini nasıl ayarlarsınız?
Enerji tüketimi	29	Kullandığınız diğer ürünlerle karşılaştırdığınızda elektrikli çay makinenizin enerji tüketimi nasıl?
	30	Elektrikli çay makinenizi kullanırken –demleme öncesinde, demleme sırasında veya çayınız demlendikten sonra- enerji tüketimini azaltmak için kullandığınız yöntemler var mı?
	31	Kullanım sırasında enerji tüketimini azaltmak için dikkat ettiğiniz şeyler var mı?
	32	*Sizce enerji tüketimini azaltmak için elektrikli çay makinesine ne gibi özellikler eklenebilir?
Demleme sonrası	33	*Çay hazırlama sürecine geri dönersek, diyelim ki çay demlendi, demlenme sürecinin sonunda neler yaparsınız?
	34	*Çay makinesini ne zaman kapatırsınız, fişini çeker misiniz? Neden?
	35	*Çayı sıcak tutmak için ne yaparsınız?
	36	Kendi çay makinenizi kullanırken demleme veya suyun kaynaması ile ilgili bir sorun yaşadınız mı? *[Örneğin, demin istediğiniz koyulukta olmaması, suyun sıcaklığının istediğiniz derecede olmaması, vb.]*

Ek ayarlar	37	*Sizce demleme ve su sıcaklığının ayarlanması süreçleri açılarından çay makinesine ne gibi özellikler eklenebilir?
	38	*Isı ayarı yapmak ister misiniz? Nasıl?
	39	*Zaman ayarı yapmak ister misiniz? Nasıl?
	40	*Çay makinesi ayarlarıyla ilgili eklemek istediğiniz özellikler var mı? Neden?
Çay servisi	41	*Seçtiğiniz senaryo için demlenen çayın servisini nasıl yaparsınız?
	42	Çay makinesinin bütününü ya da bir parçasını servis aşamasında başka bir yere ya da odaya taşıyor musunuz? Neden?
	43	Çay servisini siz mi yapmayı tercih edersiniz? Başka tercihiniz var mı?
	44	Çayın tazelenmesine, yeniden demlenmesine ihtiyaç duyar mısınız? Nasıl yapmayı tercih edersiniz?
	45	*Servis için ek bir ürün kullanır mısınız? Neden?
	46	*Servis için nasıl bir tepsi tercih edersiniz? Neden?
	47	*Servis için nasıl bardaklar ve bardak altlıkları tercih edersiniz? Neden?
	48	*Servis için nasıl çay kaşıkları tercih edersiniz? Neden?
	49	*Servis yaparken başka ne tür ürünler ya da aksesuarlar kullanırsınız? Neden?
	50	*Sizce servis açısından çay makinesine ve servis elemanlarına ne gibi özellikler eklenebilir?
Temizlik	51	*Elektikli çay makinesinin temizliğini nasıl yaparsınız?
	52	*Elektikli çay makinesinin içini nasıl temizlersiniz?
	53	*Elektikli çay makinesinin süzgecini nasıl temizlersiniz?
	54	*Elektikli çay makinesinin dışını ve kapağını nasıl temizlersiniz?
	55	Temizlerken ne gibi zorluklarla karşılaşıyorsunuz?
	56	*Sizce temizlik açısından elektrikli çay makinesine ne gibi özellikler eklenebilir?

Bakım – onarım	57	Daha önce elektrikli çay makineniz bozuldu mu veya hiç servise götürdünüz mü? Neden?
	58	Elektrikli çay makinenizin bozulmaması için, kullanırken özellikle dikkat ettiğiniz şeyler var mı? Neden?
	59	Sizce elektrikli çay makinesi için tamir veya servis önemli mi? Neden?
	60	Elektrikli çay makinesi ile ilgili bir kaza yaşadınız mı?
	61	*Bir kaza yaşanmaması için elektrikli çay makinesine ne gibi özellikler eklenebilir?
	62	*Diyelim ki bu elektrikli çay makinesini uzun süredir kullanıyorsunuz ve artık eskidiğini düşünüyorsunuz. Çay makinesini elden çıkarmadan yenileme şansınız olsaydı, hangi parçalarını yenilemek isterdiniz? Neden?[*Katılımcı yanıt vermekte zorlanırsa*] Örneğin demliği, kordonu, kulbu, kapağı, filtresi, ayar düğmeleri veya ayar özellikleri.
Ek özellikler ve iyileştirmeler	63	*Oluşturduğunuz bu elektrikli çay makinesine yeni bazı özellikler ekleseydiniz, neler eklemek isterdiniz? [*Katılımcının bu soruları (63-67) yanıtlarken biraz zamana ihtiyacı olabilir. Katılımcının DYM sürecinde elektrikli çay makinesine veya servis elemanlarına eklediği özellikler araştırmacı tarafından hatırlatılır ve katılımcıya başka eklemek istediği bir şey olup olmadığı bir kaç kez sorulur.*]
	64	*Oluşturduğunuz bu servis elemanlarına yeni bazı özellikler ekleseydiniz, neler eklemek isterdiniz?
	65	*Bu elektrikli çay makinesinde bazı iyileştirmeler yapsaydınız neler yapardınız?
	66	*Bu servis elemanlarında bazı iyileştirmeler yapsaydınız neler yapardınız?
	67	Tüm süreçleri yeniden düşündüğümüzde, çay demleme ve çay servisi ile ilgili üzerinde yeterince konuşmadığımız veya eklemek istediğiniz herhangi bir şey var mı?

Çalışmamıza gerçekten önemli bir katkıda bulundunuz. Katıldığınız ve zaman ayırdığınız için çok teşekkür ederiz.

Görüşmeyi yapan araştırmacılar	
Görüşme tarihi	
Görüşme yeri	
Toplam görüşme süresi	
Katılımcının adı, soyadı	
Cinsiyeti	
Yaşı	
Eğitim düzeyi	
Mesleği ve işi	
Kullandığı çay makinesinin markası	
Çay makinesini kaç yıldır kullandığı	
Katılımcının sahip olduğu çay makinesinin fotoğrafı	
Katılımcının sahip olduğu servis setinin fotoğrafı	
Katılımcının DYM sürecinde oluşturduğu çay makinesinin fotoğrafları	
Katılımcının DYM sürecinde oluşturduğu servis setinin fotoğrafları	

APPENDIX Z

THE ERM INTERVIEW SCHEDULE FOR ENGAGING AND SUSTAINABLE DESIGN SOLUTIONS FOR TEA MAKING AND SERVING EXPERIENCE PROJECT

Z.2 ENGLISH

Middle East Technical University Faculty of Architecture

Department of Industrial Design Spring 2012-13 ID 302 Industrial Design IV

Asst. Prof. Dr. Çağla Doğan, Asst. Prof. Dr. Fatma Korkut, Part-time Inst. Mustafa Hasdoğan, Part-time Inst. Dr. Harun Kaygan, Res. Asst. Koray Benli, Res. Asst. M. Erdi Özgürlük, Res. Asst. Sedef Süner, Res. Asst. Senem Turhan

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Engaging and Sustainable Design Solutions for Tea Making and Serving Experience

Experience Reflection Modeling, (ERM) Interview Schedule

Notes to the researchers
Things to be taken into account during ERM sessions: The ERM is a design research method which helps users to reflect on their needs, experiences, preferences and expectations regarding a product. During the session the researcher asks questions to the participant by using the ERM schedule provided. In response to that the participant expresses her/his thoughts (i.e. she/he "thinks aloud") as she/he builds a 3D model of a particular product by using the tool kit provided. This process helps the participant to recall his/her experiences about the product and to reflect on his/her preferences and needs related to the product. It is important to understand the participant's priorities and preferences together with their reasons while she/he brings together the components of the 3D model. For the questions marked with a star (*), active involvement of the participant in the model making process should be encouraged. Additionally, the researcher should ask questions after the participant's responses such as "Why would you prefer this/that?" or "What else would you prefer?" to understand the motives behind the preferences. If the participant asks for it, the researcher may help the participant in 3D modeling process without directing him/her. ERM session requires team work; it is recommended that at least one student is responsible for video recording, one for taking pictures of the model being constructed, one for asking questions to the participant, and one for helping the participant for 3D modeling process. Before the ERM session, please give the informative text about the ERM (METU_ID302_Spring2013_TeaMakingServing_info_p_eng.docx) and concent form (METU_ID302_Spring2013_TeaMakerServing_03_ERMConsentForm.docx) to the participant. The participant is expected to read the informative text before the ERM session. If not, you can briefly mention about the ERM session before you start the session.

We would like to give you brief information about our research before starting the session. We are third year students at the METU Department of Industrial Design. My name is.... The names of the others in the session are ..... and ..... We are conducting this research in the context of our design course and the doctoral thesis of Res. Asst. Senem Turhan. We would like to understand your opinions related to an electrical tea maker and its serving set. The research results will only be used for educational purposes, journal publications, presentations and thesis work. We will use your explanations for scientific purposes. We will video and audio record this session in order to remember exactly what you said and did. Your personal information will be kept confidential. This session will take approximately one hour. Is there anything you would like to ask before starting the session?

Before starting let's select a scenario which represent an occasion for which you use your electrical tea maker frequently. Some examples would be "sunday breakfast", "tea break at office" or "guest hosting". Let's demonstrate tea brewing and serving process for that particular occasion.

Preparation	1	*Before starting preparing tea, let's decide on the main parts of the tea maker. For example, what size water tank or teapot would you prefer? Why? How would you like their appearances to be? Why? How would you prefer their order to be? Why?
	2	What kind of preparations would you make before brewing tea with the electrical tea maker?
	3	Would you keep the tea maker near a power socket,or would you change its location before using?
	4	*Could you please place the electric cable on the model?
	5	For how many people would you serve tea for your scenario that you selected?
	6	Could you explain tea making process with the help of the 3D model? [*After that, the sequence of questions might change according to the sequence of the participant's tea making process.*]
	7	* How would you decide on the amount of water in the water tank?
	8	*From where and how would you fill water?
	9	*Which material would you prefer for the water tank? Why?
	10	*How would you prefer handle of the water tank to be? Why?
	11	* How would you prefer lid of the water tank to be? Why?
	12	* How would you prefer spout of the water tank to be? Why?
	13	* When would you turn on the tea maker? How would you turn it on? *Assume that you turn on the tea maker. How would you be sure that the tea maker is on?
	14	*Would you prefer something else to be sure that it is on? Why?

	15	*Now water is getting prepared. How would you understand that the water is ready?
Tea brewing	16	* How would you brew the tea?
	17	*Would you use infuser? What kind of infuser would you prefer?
	18	*How would you decide on the amount of tea?
	19	*How would you decide on the temperature of the water that you use for brewing?
	20	* How would you decide on the amount of water that you use for brewing?
	21	* How would you like the positions of the water tank and teapot to be?
	22	* Which material would you prefer for the teapot? Why?
	23	* How would you prefer the handle of the teapot to be? Why?
	24	* How would you prefer the lid of the teapot to be? Why?
	25	* How would you prefer the spout of the teapot to be? Why?
	26	*Your tea is brewing now. How often and how would you check the tea during brewing?
	27	*How would you be sure that the tea is ready?
	28	How would you adjust the time for brewing?
Energy consumption	29	How is your tea maker's energy consumption in comparison to other electrical products that you use at home?
	30	Is there any method that you use for reducing the energy consumption during the use of your tea maker (before, during, after brewing)?
	31	Is there any measure that you take to save energy during the use of your tea maker?
	32	*What kind of features would you like to add to the tea maker to reduce the energy consumption?
After brewing	33	* Let's go back to the tea making process. Assume that the tea is brewed, what would you do after the brewing process?
	34	*When would you turn off the tea maker? Would you unplug it? Why?
	35	*What would you do to keep the tea warm?
	36	Is there any problem that you have experienced with your tea maker related with boiling of water or brewing the tea? [*For example, having too light/too dark tea, or having too hot/ too cold water, etc.*]

Additional controls	37	*What kind of features would you like to add to the tea maker for brewing tea and controlling water temperature?
	38	*Would you like to have a temperature setting? How?
	39	*Would you like to have a time setting? How?
	40	*Is there any feature that you would like to add in terms of displays and controls? Why?
Tea serving	41	*How would you serve tea for your selected scenario?
	42	Do you carry the whole or a part of the tea maker to another place or room for serving process? Why?
	43	Do you prefer to serve the tea by yourself? Do you have any other preferences?
	44	Do you usually re-brew tea? How would you prefer to do this?
	45	*Would you use additional products for serving the tea? Why?
	46	*What kind of tray would you prefer for serving the tea? Why?
	47	*What kind of tea glasses and saucers would you prefer for serving the tea? Why?
	48	* What kind of tea spoons would you prefer for serving the tea? Why?
	49	*What other accessories or products do you use for serving the tea? Why?
	50	*What kind of features would you like to add to the tea maker and its serving set in terms of service?
Cleaning	51	*How would you clean the tea maker?
	52	* How would you clean the inside of the tea maker?
	53	* How would you clean the infuser of the tea maker?
	54	* How would you clean the outside and the lid of the tea maker?
	55	What kind of difficulties do you face during the cleaning process?
	56	* What kind of features would you like to add to the tea maker for cleaning?

Maintenance	57	Have your tea maker ever been broken before? Or have you ever taken it to a technical service before? Why?
	58	Is there anything you do to prevent any potential damage to your tea maker? Why?
	59	Is repair and maintenance important for the tea maker? Why?
	60	Have you ever experienced any accident related to your electric tea maker?
	61	* What kind of features would you like to add to the tea maker to prevent accidents?
	62	*Assume that you have been using this tea maker for a long time and you think that it is outdated. If there is an opportunity to renew the tea maker without discarding it which parts would you like to replace or renew? Why? [*If the participant has difficulty to answer the question*] For example, teapot, cable, handles, control buttons, etc.
Additional features & improvements	63	* What kind of new features would you like to add to this tea maker? [*The participant may need time to answer these questions (63 -67). The features that the participant has added to the tea maker during the session are reminded by the researcher, and the question is asked again.*]
	64	* What kind of new features would you like to add to this serving set?
	65	* What kind of improvements would you make for this tea maker?
	66	* What kind of improvements would you make for this serving set?
	67	Considering the whole process, is there anything that we didn't mention or we missed about tea making and tea serving?

Thank you very much for your participation. We really appreciate your contribution to our research.

Resechers conducted the session	
Date of the session	
Place of the session	
Duration of the session	
Name, Surname of the participant	
Gender	
Age	
Educational level	
Occupation	
Brand of the tea maker that she/he uses	
Duration of the tea maker that has been owned	
Pictures of the tea maker that the participant has	
Pictures of the tea maker that the participant has build up during the ERM session	
Pictures of the service set that the participant has	
Pictures of the service set that the participant has build up during the ERM session	

APPENDIX AA

THE THANK YOU LETTERS GIVEN TO THE PARTICIPANTS AFTER THE ERM SESSIONS

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MİMARLIK FAKÜLTESİ | ENDÜSTRİ ÜRÜNLERİ TASARIMI BÖLÜMÜ

Sayın

2011-2012 Akademik Yılı Bahar döneminde yürütülen ID302 Endüstri Ürünleri Tasarımı IV dersi kapsamında gerçekleştirilen "ODTÜ - Esse işbirliğiyle Elektrikli Çay Makinesi ve Servis Elemanları Tasarımı " başlıklı projede yürütülen Deneyim Yansıtma Modellemesi araştırma sürecine yapmış olduğunuz değerli katkılardan dolayı bölümümüz adına teşekkür ederiz.

Yrd. Doç. Dr. Fatma Korkut

Yrd. Doç. Dr. Çağla Doğan

MART 2012

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MİMARLIK FAKÜLTESİ ENDÜSTRİ ÜRÜNLERİ TASARIMI BÖLÜMÜ

Sayın

2012-2013 Akademik yılı bahar döneminde ID302 Endüstri Ürünleri Tasarımı IV dersi kapsamında ODTÜ'de gerçekleştirilen "Çay Demleme ve Servis Etme Deneyimi için Sürdürülebilir Tasarım Çözümleri" başlıklı projede Deneyim Yansıtma Modellemesi araştırma sürecine yapmış olduğunuz değerli katkılardan dolayı bölümümüz adına teşekkür ederiz.

Çağla Doğan, Fatma Korkut, Mustafa Hasdoğan, Harun Kaygan, Koray Benli, M. Erdi Özgürlük, Sedef Süner, Senem Turhan

MART 2013

APPENDIX BB

THE CONSENT FORM FOR THE ERM SESSIONS

BB.1 TURKISH

Orta Doğu Teknik Üniversitesi (ODTÜ)

Mimarlık Fakültesi Endüstri Ürünleri Tasarımı Bölümü

Elektrikli Çay Makinesi ve Servis Deneyimi Tasarımı Eğitim Projesi

Deneyim Yansıtma Modellemesi Araştırması

Mart 2013

Görüşme için katılımcı izin formu:

Bu araştırma, ODTÜ Endüstri Ürünleri Tasarımı Bölümü üçüncü yıl tasarım dersi ve Araş. Gör. Senem Turhan'ın doktora tez çalışması kapsamında yapılmaktadır. Araştırmanın amacı kullanıcıların, çay makinesi kullanımına ve çay servisine yönelik deneyim ve görüşlerini öğrenmektir. Görüşme sırasında elde edilen veriler yalnızca bilimsel amaçlarla, tasarım sürecinde, tez çalışmasında, bilimsel yayınlarda ve sunuşlarda kullanılacaktır. Katılımcıların kimlik bilgileri saklı tutulacaktır. Konuşulanları ve süreci daha sonra tam olarak hatırlayabilmek ve gözden geçirebilmek için görüşme kaydedilecektir. Görüşme sırasında fotoğraf makinesi, video ve ses kayıt cihazı kullanılacaktır. Görüşme yaklaşık bir saat sürecektir.

Bu formu imzalayarak yapılacak araştırma konusunda size verilen bilgiyi anladığınızı ve görüşme yapılmasını onayladığınızı belirtmiş oluyorsunuz. Formu imzalamış olmanız yasal haklarınızdan vazgeçtiğiniz anlamına gelmemektedir; ayrıca araştırmacının, öğrencilerin, ilgili kişi ve kurumların yasal ve mesleki sorumlulukları devam etmektedir. Çalışmaya katılım gönüllülük esasına dayanır. Araştırma, katılımcılar açısından herhangi bir risk taşımamaktadır. Görüşme sürecinin başlangıcında veya herhangi bir aşamasında açıklama yapılmasını veya bilgi verilmesini isteyebilirsiniz. İstediğiniz zaman gerekçe belirtmeksizin görüşmenin durdurulmasını talep edebilirsiniz. Araştırmaya katkıda bulunduğunuz için teşekkür ederiz.

Katılımcının adı soyadı	**İmza**	**Tarih**
Öğrencilerin adları soyadları	**İmzalar**	**Tarih**

Araştırmadan sorumlu öğretim elemanları:

ODTÜ Mimarlık Fakültesi Endüstri Ürünleri Tasarımı Bölümü

Tel: 0312 210 22 14

Araş. Gör. Senem Turhan	Yrd. Doç. Dr. Çağla Doğan
turhan.senem@gmail.com	dcagla@metu.edu.tr

Bu formun bir kopyası katılımcıya verilmelidir.

APPENDIX BB

THE CONSENT FORM FOR THE ERM SESSIONS

BB.2 ENGLISH

Middle East Technical University (METU)

Faculty of Architecture, Department of Industrial Design

Engaging and Sustainable Design Solutions for Tea Making and Serving Experience Project

Experience Reflection Modelling Research

March 2013

Consent Form for the Participant:

This research will be conducted in the context of a third year undergraduate course and the doctoral study of Res. Asst. Senem Turhan at the Department of Industrial Design, METU. The aim of the research is to understand your experiences and opinions related to the use of electrical tea maker and its serving set. The research results will only be used for educational purposes, journal publications, presentations and thesis work. The session will be video and audio recorded in order to remember exactly what you say and do. Your personal information will be kept confidential. This session will take approximately one hour. Your participation is voluntary and you may withdraw from the study at any time, in which case your responses would not be used.

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. Your signature on this form indicates that you have understood the information regarding your participation in the research project and agreed to participate as a subject. In no way does this waive your legal rights nor release the investigators or involved institutions from their legal and professional responsibilities. Thank you for your participation.

Name, Surname of the Participant	**Signature**	**Date**
Name, Surname of the Students	**Signatures**	**Date**

If you have further questions concerning matters related to this research, please contact:
METU Faculty of Architecture, Department of Industrial Design

Tel: 0312 210 22 14

Res. Asst. Senem Turhan	Assist. Prof. Dr. Çağla Doğan
turhan.senem@gmail.com	dcagla@metu.edu.tr

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

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Turhan, Senem

Nationality: Turkish

Date and Place of Birth: 22 April 1982, Denizli

E-mail: turhan.senem@gmail.com

EDUCATION

Degree	Institioution	Year of Graduation
MS	METU Department of Industrial Design	2009
BS	METU Department of Industrial Design	2005

WORK EXPERIENCE

Year	Place	Enrollment
2007- Present	METU Department of Industrial Design	Research Assistant
2005-2007	Motali Technological Systems A.S.	Industrial Designer

FOREIGN LANGUAGES

Advanced English

PUBLICATIONS

Bakirlioglu, Y., Dogan, C., & Turhan, S. (2013). Evolving Sustainable Product Design Considerations for Electrical Household Products. In Proceeding of Sustainable Innovation 2013. Sustaınable Innovatıon 2013: Collaboration, Co-creation & New Business Models, 18th International Conference, 4 - 5 Nov. 2013, University for the Creative Arts, Epsom, Surrey, UK.

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