An Initial Model for Generative Design Research: Bringing together Generative Focus Group (GFG) and Experience Reflection Modelling (ERM)

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Abstract

Understanding people's experiences and the context of use of a product at the earliest stages of the design process has in the last decade become an important aspect of both the design profession and design education. Generative design research helps designers understand user experiences, while also throwing light on their current needs, preferences and future expectations.

In this paper, two complementary methods, namely the Generative Focus Group (GFG) approach and Experience Reflection Modelling (ERM), will be presented through a research case focusing on the development of sustainable design considerations in the areas of effective use of resources, and product maintenance and repair. The first method makes use of generative tools (i.e. diaries and timelines) to gain feedback from a group of experienced users. It facilitates group discussions and enables engaging user participation to develop potential design directions. In contrast, the second method utilizes a special toolkit of abstract two- and three-dimensional product parts to reveal the needs, preferences, and expectations of the individual in a more in-depth manner, with the intention being to further explore the insights and design directions that emerged during the application of the first method. This paper proposes an initial model that brings together these two methods, incorporating generative tools and techniques that are adaptable, participatory and engaging, and discusses their implications for design education.

Key words

Generative Research, Experience Reflection Modelling (ERM), Generative Focus Group (GFG), early stages of design process, design education

Introduction

Design practice is undergoing a transition in meaning, from the mere giving of form to artefacts towards a more human-centered understanding of design (Denton and McDonagh, 2003). As a result of the significance of human behaviors, needs and preferences when defining emerging demands and expectations, design research emerged as an important part of the design process. Following a parallel path, design education is also undergoing a transition, and is revealing the potentials of taking into account user knowledge, including human factors, experiences and interactions, for the design process. Consequently, with the aim of enabling design students to transfer the research knowledge into a more attentive design process, user research has become an integral part of the design education curriculum of various design departments (Wormald, 2011; Arnold, 2009; Buchanan, 2004). User research conducted in an educational context not only helps design students expand their knowledge and skills by giving them an understanding of use experience and context in the development of design solutions, but also empowers a research-orientated learning environment in design education. In this way, design students feel more confident, and are able to develop design ideas that are based on the integration of design and research knowledge.

As any designed object is intended for use by people, knowledge focusing on use experience and context should be an integral part of the design process (Hanington, 2007; Mitchell, 1995). The involvement of people in the design process is perceived as an expansion of the designers' viewpoint, in that it provides a critical understanding of people's needs, preferences and experiences, as well as the context of use. Such a comprehensive understanding helps design researchers avoid biases that stem from their assumptions about users. Aside from the context of use and experience, there is also a need to explore people's future expectations, so as to better inform the design process.

The means by which people are involved in design research affects the depth of knowledge that can be gathered through it. The tacit knowledge and latent needs of people cannot only be retrieved from what they say (Sanders, 2001, Polanyi, 1964), as generative research tools and techniques can used to garner a deeper understanding of user knowledge, feelings and dreams,

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revealing both tacit knowledge and latent needs (Sleeswijk Visser et al., 2005). Generative design research methods can uncover more profound user knowledge, and so can better inform the early stages of the idea-generation phase of a design process, and so offer many potentials for design education in support of creative learning and reflection processes. Accordingly, new generative research methods that can be adopted in educational design projects need to be developed and introduced to the body of design research literature.

In this paper, two generative design research methods – i.e. Experience Reflection Modelling (ERM) (Turhan, 2013) and Generative Focus Group (GFG) (Oğur, 2014) – will be presented, highlighting their complementary nature in informing the idea-generation phase of a design process. Making use of a research case, how these two methods can be brought together will be discussed, and an initial model will be put forward for design education.

The generative tools and techniques

Generative research methods can be used for the collection of in-depth data about user experiences related to a research topic through the use of such generative tools and techniques as collages, diaries and mind-maps. (Sanders et al., 2010; Levitt and Richards, 2010; Hanington, 2007). Generative research methods aim to reveal user experiences in four main phases (Sanders et al., 2010):

- 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 for the future related to the research topic.

Various tools and techniques are used in generative design research for different purposes and contexts. Of these, some are projective, and aim to encourage people to explain their thoughts and experiences in detail, including diaries, text- or image-based cards, and daily logs; while others are constructive, and aim to enable people to make tangible things that represent their thoughts and experiences, and include Velcro modelling, collages and mind-mapping. Sanders et al. (2010) classify these tools and techniques according to their forms, purposes and contexts. These tools and techniques enable non-designers to express their thoughts and experiences effectively during generative research sessions (Arnold, 2009), and various combinations of these tools and techniques can be used, depending on the purpose of the research (Sanders, 2000). Table 1 below presents the

		Purpose				Context			
	Tools & Techniques	Probe	Prime	Understand	Generate	Individual	Group	Face-to-Face	Online
Making tangible things	2-D collages using visual and verbal triggers	X	X	X	X	X	X	X	X
	2-D mappings using visual and verbal components		X	X	X		X	X	X
	3-D mock-ups using foam, clay, Legos and etc.			X	X			X	X
Talking, telling and explaining	Stories and story boarding		X	X	X	X	X	X	X
	Diaries and daily logs	X	X	X		X		X	X
	Cards to organize, categorize and prioritize ideas			X	X	X	X	X	

Table 1. Tools and techniques used in GFG and ERM (Adapted from Sanders et al., 2010)

generative tools and techniques used in the development of the generative methods presented in this paper.

Introducing new research methods that bring together generative tools and techniques for design education is crucial for broadening the students' understanding of design based on user knowledge, and in enriching their creativity in the problem-solving process (Yeo, 2012; Bennett, 2006). As mentioned previously, generative research can reveal user experiences, knowledge and future expectations (Sleeswijk Visser et al., 2005), and in this regard, integrating generative methods into the design process within an educational context empowers design students in their design practice by providing them with tools and techniques that can (1) ease their role as design researchers, (2) allow access to profound user knowledge, and (3) encourage them to adapt research methods for future professional experiences. The methods explained throughout this paper (i.e. GFG and ERM) are linked closely to these attributes. In the following section, how GFG and ERM as complementary methods support each other will be explained, with a proposal presented for an initial model for the integration of generative research into design education.

An Initial Model for Generative Design Research and Design Education

GFG and ERM are two complementary generative research methods with potential for integration into design education, both of which are well-structured and easily applicable to the design education context. The GFG

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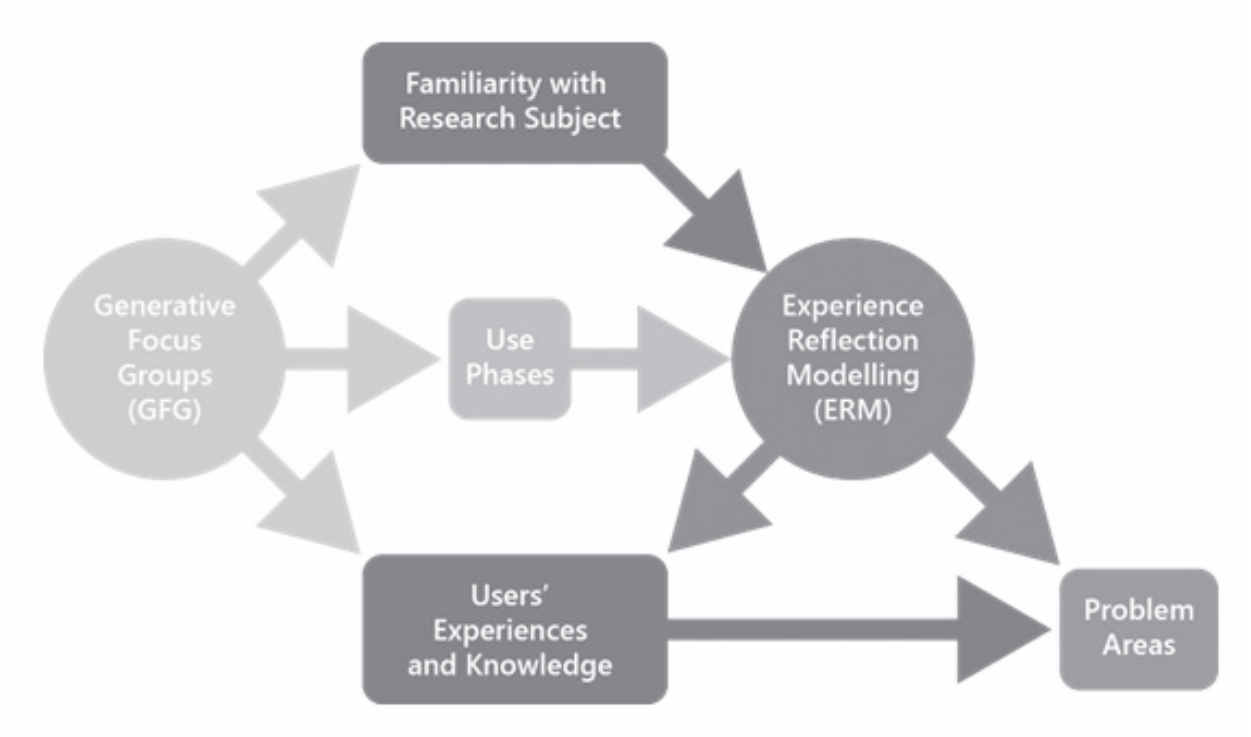

Figure 1. Relationships between the Generative Focus Group (GFG) method and Experience Reflection Modelling (ERM) in terms of the user experiences and knowledge revealed in the identification of problem areas.

method uses projective tools and techniques to reveal user experiences during the use phase of a product, encouraging the participants to explain their thoughts and experiences in detail. As a warm-up session, it prepares the participants for the ERM sessions, and provides those involved with necessary information regarding the use phases of the product, allowing the interview schedule to be prepared in line with the research topics. ERM makes use of constructive tools and techniques that enable participants to build tangible models that represent their thoughts and experiences, as well as their tacit knowledge. The information related to experience is then analyzed to identify problem areas related to the product of inquiry (Figure 1).

The ERM method was developed within the context of a design education project at the undergraduate level between 2011 and 2014 in the Department of Industrial Design of Middle East Technical University (METU). The method was then applied to a comprehensive, research project funded by TÜBİTAK (3501 Career Development Program) looking into the development of sustainable design considerations for small household appliances. As an expanding product category, small household appliances sector is growing in the number of product types it includes, and it is becoming more and more accepted in domestic environments. Furthermore, due to its growing acceptance in these environments, energy consumption in this product category has been steadily increasing (Energy Saving Trust, 2012), meaning that there is a need to develop design considerations in line with sustainability approaches.

In the first phase of the research project, the awareness of designers and manufacturers of sustainability considerations in small household appliances were investigated through semi-structured interviews, after which, user research was begun involving two main components, namely warm-up and ERM sessions. To prepare the users for the ERM sessions, a more structured and comprehensive approach was adopted in the warm-up sessions that led to the development of the GFG method. In the following sections, the main parts of these two methods, along with the projective nature of GFG and the constructive nature of ERM, will be discussed within the context of this research case.

Generative Focus Group (GFG)

Development of the GFG Method

GFG was developed as a means of data gathering with the intention of providing a comprehensive understanding of the participants' use experiences and to gain their insights

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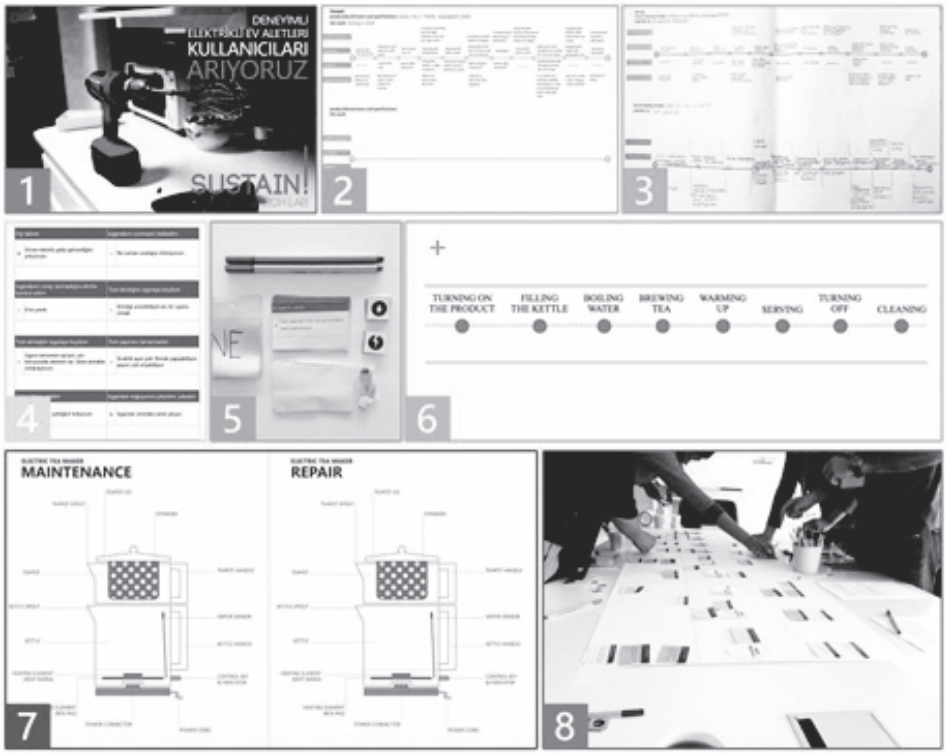

Figure 2. Preparing and conducting the GFG session: (1) invitation for potential participants, (2) individual timeline template on A3 paper, (3) filled-out individual timeline, (4) experience cards (approximately 8x6cm), (5) color-coded toolkits, including resource icons and experience cards, (6) inclusive timeline (around 2 meters long), (7) product diagrams on A1 paper, (8) a snapshot from the session, showing the research setting.

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into a particular research topic. In this research case, focusing on the effective use of resources, and product maintenance and repair in household appliances, the GFG sessions were facilitated to gain insights into user experiences, and to prepare potential participants for the ERM sessions to be conducted in the following phase of the research. Interaction among the participants in the GFG sessions was significant, and allowed a better understanding of the use experiences and the development of strategies related to the main research topics. In this regard, the facilitation of engaging discussions became invaluable in exploring the multiple facets of these topics.

The GFG method differs from the focus group method, involving a combination of complementary generative tools (e.g. individual and inclusive timelines, experience cards, product diagrams, etc.) to stimulate the participation of the users. The GFG method involves people in the sessions to significant effect, since it includes a well-structured preparation stage that eases the workload of both the facilitator and the participants.

The aim of the GFG method is quite similar to that of the user observation approach, yet the adopted research environment in this method differs entirely. User observations are commonly carried out in real-life contexts with focus on a particular product or activity, whereas GFG sessions are conducted in a controlled environment in the absence of the product of inquiry. The GFG method provides researchers with knowledge of user experience and insight, and enables the users to participate in the discussions actively and effectively through the integration of supplementary tools (i.e. an individual timeline, experience cards).

The GFG method makes use of a combination of projective generative tools (i.e. individual and inclusive timelines, experience cards, resource icons and product diagrams) and techniques (i.e. card sorting) to gather information regarding user experience and to gain insight into the effective use of resources, and product maintenance and repair. The key stages of a GFG session are explained below in three steps, along with the means of development and the integration of the generative tools.

Preparation Stage of the GFG Method

Prior to the GFG sessions, a comprehensive preparation stage is undertaken to ensure the active involvement of the participants. This step includes the preparation of an interview schedule and the generative tools, the recruiting of participants and the arrangement of a venue for the sessions (Figure 2).

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An *individual timeline* is a user diary that is developed to gain a comprehensive insight into user behavior and experiences within the context of use. The participants record their experiences on their individual timeline, indicating the use phases, product feedbacks, and their experiences, whether negative or positive, in each phase. Considering the main aim and scope of the study, the employed timeline involved entire the use phase of a product (e.g. preparing, operating, cleaning, storing, etc.), although in other studies it may focus on specific phases, depending on the purpose of the research.

The individual timelines were filled out by the users and returned to the researcher a few days prior to the session so that the participants' statements could be transferred onto the templates for the preparation of experience cards. The experience cards template lists the name of the use phase and related experience, whether positive or negative, and these cards were printed in different colors for each participant in a later stage to form part of the color-coded toolkits. The experience cards aimed to transfer the data from the individual timelines to the GFG sessions to enable the participants to recall and discuss their experiences collectively. Afterwards, based on the participants' consonant and conflicting views in the use phases, as recorded on the individual timelines, an inclusive timeline was created for each product case. This inclusive timeline allowed the participants to organize and categorize their experiences under the relevant use phases, and to discuss each other's experiences during the sessions.

In order to gain the insights of the participants into the use phases that consume resources excessively and/or unnecessarily, resource icons for water and electricity were provided in different colors for each participant. Additionally, product diagrams were prepared separately for each product category, and for each session two diagrams were printed out separately for product maintenance and repair. The diagrams showing and identifying the individual product parts aim to reveal the users' experiences in terms of maintenance patterns and the reasons for breakdown for the product of inquiry.

While developing and preparing the generative tools, a short invitation was prepared and distributed via e-mail and on social media to recruit potential participants. The sessions were scheduled upon receiving the consent of the prospective participants top take part in the study. Finally, the research setting was arranged for the GFG sessions, and the audio and video recording devices were set up to record the participants' interactions with the generative tools and with each other.

Conducting the GFG Sessions Part-I

A total of seven GFG sessions were carried out with 30 participants, distributed as follows:

- 1 session for electric tea makers (4 participants)
- 1 session for blenders/choppers (5 participants)
- 1 session for Turkish coffee makers (4 participants)
- 2 sessions for contact grills (5 + 3 participants)
- 2 sessions for vacuum cleaners (5 + 4 participants)

The sessions were conducted in two parts. The first part focused on exploring the positive and negative experiences of the participants with the respective products, and then gaining their insights into the product with particular emphasis on the effective use of resources. During this part the participants placed their experience cards onto the inclusive timeline under the relevant use phases, and were encouraged to discuss their experiences each other (Figure 3). They were also provided with blank color-coded cards on which they were encourage to add comments or experiences that came up during the discussions. Later, the participants placed the resource icons over the use phases or the experience cards to indicate that they could be responsible for excessive and/or unnecessary resource consumption. Afterwards, the participants discussed the reasons why they thought those phases would consume resources in that way. It should be noted that these discussions on resource consumption did not reveal any factual data, but rather the participants' insights into resource consumption for further discussion. This part of the GFG sessions took approximately 45–50 minutes.

Figure 3. Images from the GFG sessions; placing experience cards on the inclusive timeline (left), attaching resource icons to the related use phases and/or experience cards (right).

Conducting the GFG Sessions Part-II

The final part of the session focused on revealing the participants' insights into product maintenance and repair for each product category, and exploring the related problem areas. In this regard, it involved refined product diagrams with room for the participants to write down

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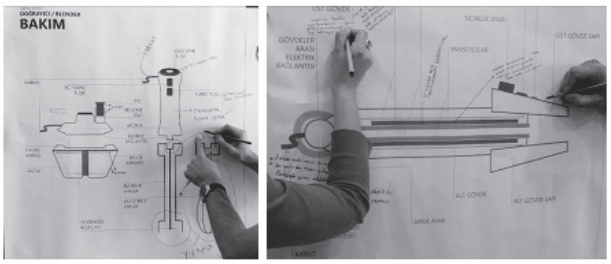

Figure 4. Images from the GFG sessions - participants revealing their insights considering product maintenance on blender diagram (left), and product repair on contact grill diagram (right).

their comments and insights about product maintenance in relation to product parts for the selected product categories (Figure 4). This part of the GFG sessions took approximately 15–20 minutes.

The structured nature of the GFG method, along with its generative tools and techniques, made the researchers' role as facilitator easier when compared to conventional focus group sessions. The generative tools used in the GFG sessions facilitated easy discussions between the participants to uncover their in-depth use experience knowledge. Consequently, the GFG sessions revealed more detailed information on user experiences than initially anticipated. By utilizing generative techniques and tools in a structured manner, the GFG method presents potentials in its integration into design education, in that it enables novice designers to gain experience as facilitators in a focus group context. In a research project context, the sessions are facilitated by experienced researchers, whereas in design education projects, design students may need further guidance from course instructors or the studio team in the preparation of the generative tools and the facilitation of the sessions. An introduction to the method can be supported by rehearsal sessions, so that the design students can become more familiar with the application of the method. Alternatively, the generative tools used in this method can be only partly adopted, considering the purpose of the educational project. For instance, the individual timelines can be used by students in user observations to record use phases in line with use experiences. Furthermore, in the second part the product diagrams can be used by themselves in a generative session to better understand user experiences and needs regarding product maintenance and repair, which can also stimulate engaging discussions highlighting the issues around a specific product part.

Experience Reflection Modelling (ERM)

Development of the ERM Method

The Experience Reflection Modelling (ERM) method was developed and presented in a doctoral thesis (Turhan, 2013) in the Department of Industrial Design at METU. Throughout this study, the method was developed through its integration into three different educational design projects for the design of (1) a mini-oven, (2) an electric tea maker and (3) a tea-making and serving set in the third-year industrial design studio. The ERM was developed as a design education tool, aiming to provide novice designers with the required skills to gain insight into user experiences, with educational cases focusing mainly on design for sustainability, for which the ERM method was adapted accordingly.

While developing ERM, its adaptability in the context of design education was continuously evaluated, and the generative tools to be adopted for the method were selected with the capabilities of the novice designers in mind. At the end of each application of ERM, a series of interviews were conducted with the design students to identify the benefits and difficulties faced in incorporating the ERM method into educational projects. The integration of the ERM method into design education encouraged teamwork and collaboration between students, and provided them with tangible outcomes reflecting the tacit knowledge and latent needs of the users/participants. An analysis of the ERM sessions helped design students identify problem areas with regards to the design brief, and to develop design directions for each area.

After its integration into the design education projects, ERM was planned and incorporated into the funded research project, focusing on the development of sustainability considerations for small household appliances. The ERM method explained in this section is based on this research application.

ERM is positioned between the exploratory research and idea-generation phases of the design process. User observations and/or generative warm-up sessions are necessary prior to ERM sessions, as both the participant and the designer need to be familiar with the research topic beforehand.

The ERM method uses a generative toolkit and semi-structured interviews that work in conjunction to reveal the tacit knowledge and latent needs of users that would otherwise not be revealed. The constructive generative toolkit enables participants to communicate their thoughts, feelings and preferences that may be hard to express verbally.

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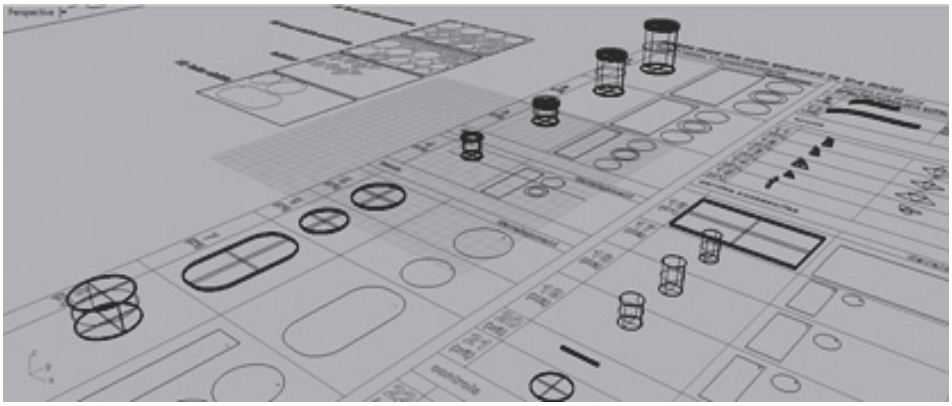

Figure 5. CAD modelling of the ERM toolkit parts and related information.

Figure 6. Assembly of the 3D parts produced with a laser cutter.

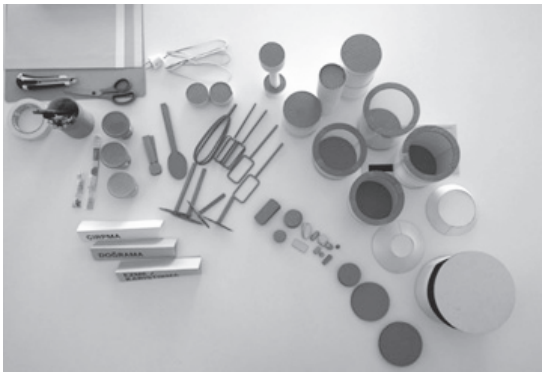

Figure 7. An example of the ERM toolkit prepared for the blender/mixer product category, including laser-cut parts and additional materials.

Preparation Stage of the ERM Sessions

The preparation stage of ERM includes preparation of the toolkit, adapting the interview schedule and arranging a venue for the ERM sessions in which video and audio recordings can be made without intervening in the sessions.

In this research case, the features of the parts (i.e. shapes, sizes, material, etc.) to be included in the 3D-modelling toolkits for each product category (i.e. tea makers, Turkish coffee makers, blenders/mixers, vacuum cleaners and contact grills) were decided upon and developed, after which they were CAD modelled and their development views drawn for each product (Figures 5). Finally, the toolkits were produced using a laser cutter and then assembled using tape and adhesive (Figures 6).

Additional materials (e.g. colored papers, color pens, putty-like pressure sensitive adhesive, play dough, paper tape, etc.) were also included in the toolkit, to be used for assembling parts and also for creating new parts that were not included in the toolkit (Figure 7).

In addition to the ERM toolkits, comprehensive interview schedules were prepared for each product category. The interview schedule template presented below (Table 2) was adapted according to the use phases of the product of inquiry derived from the GFG sessions, emphasizing user needs, preferences and expectations, as well as use of resources, product maintenance and repair.

After the preparation of the ERM toolkits (Figure 7) and the interview schedules (Table 2) for each product category (i.e. tea makers, Turkish coffee makers, blenders/mixers, vacuum cleaners and contact grills), a meeting room was arranged containing a large table on which to place the ERM toolkit, and with enough space to position a video camera and voice recorder to record the ERM sessions.

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Preparation	Let's pick a scenario in which you use *[the product]* the most before we start; and let's enact that scenario.
	Let's decide on the basic parts of the product before we enact the process. What size do you prefer *[the part]* to be? What kind of an appearance do you prefer for *[the part]*? How would you like to place *[the parts]*? Why? *(These questions are repeated for every product part throughout the session)*
	What kind of preparations do you make before using the product?
	Could you tell us the use process through the model you created? *(The order of the following questions can change according to the product of inquiry and related use phases)*
Usage	When do you turn on *[the product]*? How would you like to turn *[the product]* on? Let's say *[the product]* is working right now, how do you make sure it is on? Would you prefer another way to make sure the product is working? Why?
	How do you decide on adjustments (e.g. duration, temperature, etc.)? How do you make adjustments? Would you prefer to adjust them another way? Would you like to have other adjustment options for controls and displays? Why? *[These questions are extended according to the use phases derived from the GFG sessions.]*
	[The product] is working right now, how often do you check the food, drink, etc.? How do you check them? How do you decide when the process is finished?
After Use	Let's say the process is finished, what do you do upon the completion of the process? When do you turn off *[the product]*? Do you pull out its plug? Would you prefer to turn *[the product]* off in another way? Why?
	Have you ever faced a problem while using your *[product]*? In your opinion, what features could be added to *[the product]*?
Maintenance & Repair	How do you clean *[the product]*? Do you face any problems while cleaning *[the product]*? What other features should be added to *[the product]* to aid cleaning?
	Did your *[product]* break down before? Why? Did you take your *[product]* to service center? To prevent breakdown, are there any parts you handle with caution/care? Why? In order to prevent product breakdown or aging, what kind of features should be added to *[the product]*? To what extent is the repair service important for *[the product]*? Why? Did you have any accidents with *[the product]*?
	Let's say you are have been using *[the product]* for a long time and you think it is old. If you had the chance to renew any product parts, which ones would you like to renew? Why?
Resource Consumption	Compared to other small household appliances, how do you assess the energy consumption of *[this product]*? Why? Are there any tactics you use to decrease the energy consumption of *[the product]*? What features could be added to *[the product]* to decrease its energy consumption?
Additional Features & Improvements	Are there any other new features that you would like to add to *[the product]*? If you could, what kind of improvements would you like to make to *[the product]*?
	Looking back at the process, is there anything you would like to add to *[the product]* related to the use phases?

Table 2. Template for the questions asked in the ERM sessions.

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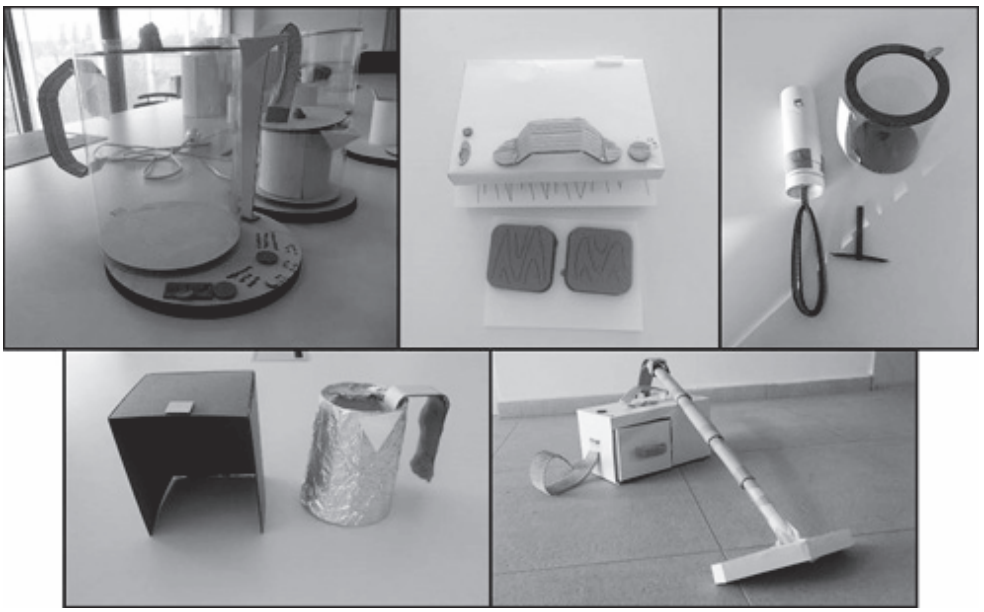

Figure 8. Examples of the 3D modelling outcomes from the ERM sessions (left to right: electric tea maker, contact grill, blender/mixer, Turkish coffee maker, vacuum cleaner).

Conducting the ERM Sessions

In this research case, the participants for the ERM sessions were selected from among those involved in the GFG sessions. The GFG provided the researchers with a preliminary understanding of user experiences, while also familiarizing the participants with the research topics and priming them for the ERM sessions. The ERM allowed a more in-depth comprehension of the context and the situation of use, as well as the participants' individual states-of-mind. A total of 20 ERM sessions were conducted, divided into the product categories as follows:

- 4 participants for tea makers
- 2 participants for Turkish coffee makers
- 5 participants for contact grills
- 3 participants for blenders/mixers
- 6 participants for vacuum cleaners

The sessions took approximately one hour, and were recorded for both audio and video. The 3D outcomes of the ERM sessions were photographed after each session (Figure 8), and then taken apart so that their parts could be used in the next session. The ERM, as a research method, can be adapted to different research aims and contexts. Abstract 3D mock-ups can be easily created with the help of CAD programs and laser-cutters and through the use of paper-based materials (e.g. cardboards, other types of paper based boards, etc.). Furthermore, the interview schedule can be modified to match the specific and potentially multiple research goals.

The engaging nature of the ERM sessions helped the participants develop the reflective models presented in Figure 8. Throughout these sessions, the researchers were able to access the tacit knowledge of the users that would otherwise not be revealed through more traditional research methods, such as user observation and semi-structured interviews. These methods (i.e. GFG and ERM) can be considered complimentary within the context of this research case, however each can be developed and adapted through the incorporation of new generative tools and techniques for other research and educational projects. In this research case, these generative tools were used to reveal sustainable design considerations for small household appliances. In a design education context, these tools can be incorporated into projects particularly in the human-centered research and early idea-generation phases. The drawing files for the toolkit and any related information may need to be prepared and provided in advance by the course instructors in a design education context, particularly if there is a time limit to the project, as this will allow design students to build their own toolkits, both easily and practically. An actual demonstration toolkit can be useful for explaining the process in detail and to show the various means of adapting and personalizing the toolkit. A template for the interview schedule should also be provided in advance, so that the design students can spend more time on rehearsing, conducting and analyzing the ERM sessions. The findings and insights gained from both the GFG and the ERM methods can be used as design directions or design solution areas for the idea-generation phase, which can lead to comprehensive design detailing in further stages.

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The implications of bringing together GFG and ERM for design research and education

Throughout this paper, two generative methods (i.e. GFG and ERM) are introduced in detail, and are considered complimentary considering their implications for design research and education. The research case, in which these two methods were used together for the first time, provided the design researchers with comprehensive information on user experiences related to the research subjects (i.e. effective use of resources, product maintenance and repair).

GFG was developed during the research case exemplified here. All parts of the GFG sessions were planned in a detailed way in terms of the incorporated generative tools and techniques, and led to the facilitation of the sessions in a practical and engaging way. The detailed and structured nature of GFG eased the role of facilitators considerably, making the method well-suited for use by design students when compared to focus group and/or user observation methods. These tools and techniques encouraged the engagement of the participants in the sessions, which in turn led to the garnering of more detailed information than expected on the use phases and related user knowledge. GFG also initiated discussions related to the effects of user behavior on the research subjects, and primed the users for the ERM sessions by helping them understand the relationship between their behaviors and the research topics. The experiences gained during the GFG sessions helped the participants understand the questions clearly and to respond to them accordingly in the ERM sessions. The results of GFG were also utilized in the development of the ERM interview schedules for each product, as these revealed the use phases and areas on which to focus for each product case. As a consequence, effective ERM schedules and sessions, tailored in line with the different product categories, were able to be prepared and conducted.

In design education, the integration of these two methods separately or in sequence into the early phases of design process can furnish design students with the necessary skills for the conducting of human-centered research and for revealing tacit user knowledge in a convenient way. These methods also aid the students in incorporating user knowledge gathered during the research phase of design process into the idea generation phase. As discussed earlier, the applied methods (i.e. ERM and GFG) improve the students' ability to conduct a human-centered research (application), to analyze user knowledge (analysis) and to compose a new meanings by combining design and user knowledge (synthesis). In this sense, it can be said that these methods aim to produce learning outcomes in a higher cognitive domain (Bloom and Krathwohl, 1956) by furnishing the students with advanced design research skills.

This paper can serve as a guideline for the bringing together of these methods, presented through a research project case study on sustainable design. While the GFG enables the researcher to gain a better understanding of the use experiences of a particular product, ERM reveals the users' needs, preferences and expectations, and analyses the results of GFG in a more in-depth manner. If the sequence of these two methods is well organized, both the design students and participants can be primed for further phases of research process. This initial model has many implications for design education in terms of bridging the gap between design students, as novice designers, and people, as users. It generates an effective way of communication to better understand the potential needs, preferences and expectations of end users, and encourages teamwork and collaboration among design students. The approach also introduces generative tools and techniques that novice designers may utilize in their future design practices and in developing their own approaches to design processes.

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