

DESIGN OF EXPERIENCE SAMPLING TOOLS FOR REPORTING STUDENT EXPERIENCE  
IN DESIGN EDUCATION

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# **ABSTRACT**

## **DESIGN OF EXPERIENCE SAMPLING TOOLS FOR REPORTING STUDENT EXPERIENCE IN DESIGN EDUCATION**

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Considering the continuous design activities that are performed throughout the design projects, design students go through several stages of decision makings, and sometimes they experience problematic situations in between consecutive supervisory meetings. Revealing all experiences during the discussions with supervisors, thus communicating the ideas could be sometimes difficult. In order to provide a better guidance, it is also important for supervisors to understand students' process in between these meetings.

There are available tools used in the fields like education or health in order to monitor an individual's daily life in relation to the context (e.g. time, place, activity) and personal circumstances (e.g. emotions, feelings, ideas). These tools are developed based on experience sampling method (ESM), a research method focus on collecting self-reported data from participants in order to measure their daily life experiences, especially during a long period of time.

Since the target group and experience has different characteristics for each context, design of experience sampling tools are also gaining importance to address these specific experience according to individuals' needs and expectations. Aiming at assisting design students to do regular self-reporting on their experiences, this study presents a background research for designing experience sampling tools that would be used by students and supervisors to keep track of students' experiences throughout design projects.

In this sense, this study intends assisting students self-reporting activities, translate the main design requirements of experience sampling tools into the context of design projects, as well as revealing guidelines for the future implications of ESM tools in design education.

Keywords: Student Experience, Experience Sampling, Design Education

# ÖZ

## **DENEYİM ÖRNEKLEME ARAÇLARININ TASARIM EĞİTİMİNDE KULLANIMI VE ÖĞRENCİ DENEYİMLERİNİN RAPORLANMASI**

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Tasarım eğitiminin temelini oluşturan stüdyo projeleri, öğrencilerin birbiri ile bağlantılı aktiviteler yaptığı, kararlar aldığı, tasarım problemleri ile ilgili çözüm önerileri ürettiği ve bunun sonucu olarak yaparak öğrendiği bir süreç olagelmıştır. Tasarım stüdyosunda ders öğretmenleri ile gerçekleştirilen düzenli toplantılar sırasında, aktiviteler değerlendirilir, tartışılır ve öğrencilerin yaparak öğrenme sürecine katkıda bulunmak amaçlanır. Dolayısı ile bu toplantılar arasında yapılan aktivite ve yaşanan deneyimlerin öğrenci tarafından doğru bir şekilde ifade edilmesi, tasarım öğrencilerinin öğrenme süreci ve öğretmenlerin bu süreçte sağladıkları rehberlik açısından önem kazanır.

Günümüzde bireylerin günlük hayatta yaşadıkları deneyimleri ifade ve rapor etmeleri için geliştirilen uygulamalar ve araçlar, bu deneyimlerin belirli bir zaman dilimi boyunca gözlemlenmesine yardımcı olmaktadır. “Deneyim örnekleme” metodu uygulanan bu araç ve uygulamaların temel amacı, bireylerin deneyimlerini dış (mekan, zaman, aktivite) ve iç (duygular, düşünceler, istekler) etkenlere dayanarak incelemektir. Bu araçlar özellikle sağlık ve eğitim alanındaki araştırma projelerine katkı sağlamaktadır. Ancak, bu araçların kullanımı bireylerin istek ve deneyimlerini ifade etmek için harcamak istedikleri zaman ve çabaya bağlıdır. Dolayısı ile bu araçların, bireyleri düzenli ve uzun süreli olarak deneyimlerini raporlamaya sevk etme özellikleri önem kazanmaktadır.

Bu bağlamda, bu çalışma tasarım öğrencilerinin stüdyo projeleri boyunca yaşadıkları deneyimleri (tasarım aktiviteleri, duygu ve düşünceler) gözlemlemeyi amaçlayan bir araç tasarımının kriterlerini incelemiştir. Öğrencilerin tasarım aktivitelerini, aktivitelerle ilgili duygu ve düşüncelerini, bunların yanı sıra stüdyo projeleri boyunca öğrenme deneyimlerini etkileyen diğer etkenlerin rapor edilmesine ve bu raporların gözlemlenmesine yönelik deneysel araştırmalar yapılmıştır. Deneyim örnekleme metodu, çalışmaların temelini oluşturmuştur. Çalışmaların sonuçlarına istinaden, öğrenci deneyimlerinin raporlanmasına yönelik deneyim örnekleme araçlarının kullanımı, tasarımı ve öğrencilerin bu araçları kullanma deneyimlerine odaklanarak, gelecekteki tasarım uygulamaları için taslak ve öneriler sunmuştur.

Anahtar kelimeler: Öğrenci deneyimi, Deneyim Örnekleme, Tasarım Eğitimi

*To Kağan Güner*



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# TABLE OF CONTENTS

<b>ABSTRACT</b> .....	<b>iv</b>
<b>ÖZ</b> .....	<b>vi</b>
<b>ACKNOWLEDGMENTS</b> .....	<b>ix</b>
<b>TABLE OF CONTENTS</b> .....	<b>x</b>

## CHAPTERS

<b>1. INTRODUCTION</b> .....	<b>1</b>
1.1. BACKGROUND AND THE NEED FOR THE RESEARCH .....	1
1.2. AIM OF THE STUDY .....	3
1.3. STRUCTURE OF THESIS.....	4
<b>2. EXPERIENCE SAMPLING TOOLS AND APPLICATIONS</b> .....	<b>6</b>
2.1. INTRODUCTION .....	6
2.2. EXPERIENCE SAMPLING TOOLS.....	6
2.2.1. DATA COLLECTION AND SELF-REPORTING.....	6
2.2.2. MONITORING PERSONAL DATA .....	9
2.3. CHAPTER DISCUSSION.....	12
<b>3. REPORTING ‘STUDENT EXPERIENCE’ DURING DESIGN PROJECTS</b> .....	<b>14</b>
3.1. INTRODUCTION .....	14
3.2. DESIGN PROJECTS AND STUDENT EXPERIENCE .....	14
3.2.1. DESIGN ACTIVITIES.....	15
3.2.1.1. “In Process” Activities .....	15
3.2.1.2. “About Process” Activities.....	17
3.3. TOOLS FOR REPORTING STUDENT EXPERIENCE.....	19
3.3.1. REPORTING DESIGN ACTIVITIES.....	19

3.3.2. REPORTING AFFECTIVE EXPERIENCES.....	21
3.4. CHAPTER DISCUSSION.....	23
3.4.1. DIMENSIONS OF REPORTING STUDENT EXPERIENCE DURING DESIGN PROJECT...	24
<b>4. EXPLORATIVE STUDIES FOR REPORTING ‘STUDENT EXPERIENCE’.....</b>	<b>25</b>
4.1. INTRODUCTION .....	25
4.2. METHODOLOGICAL APPROACH FOR EXPLORATIVE STUDIES.....	25
4.2.1. PARTICIPANTS.....	27
4.3. STUDY 1: JOURNEY MAPPING .....	27
4.3.1. Journey Mapping Sessions.....	27
4.3.1.1. Participants .....	29
4.3.1.2. Procedure .....	29
4.3.2. STUDY 1 - ANALYSIS.....	29
4.3.2.1. Results.....	30
4.3.2.2. Conclusions of Study 1 .....	31
4.4. STUDY 2: ONLINE DIARY .....	33
4.4.1. ONLINE DIARY .....	33
4.4.1.1 Participants .....	34
4.4.1.2. Procedure .....	35
4.4.2. STUDY 2 - ANALYSIS .....	35
4.4.2.1. Results .....	35
4.4.2.2. Conclusions of Study 2.....	37
4.5. STUDY 3: BOOKLET DIARY .....	38
4.5.1. BOOKLETS .....	39
4.5.1.1. Participants .....	40
4.5.1.2. Procedure .....	40
4.5.2. STUDY 3 - ANALYSIS .....	41
4.5.2.1. Results .....	41

4.5.2.2. Conclusions of Study 3 .....	41
4.6. CHAPTER DISCUSSION .....	42
<b>5. STUDY OF EXPERIENCE SAMPLING DURING DESIGN PROJECTS.....</b>	<b>45</b>
5.1. INTRODUCTION.....	45
5.2. METHODOLOGICAL APPROACH FOR MAIN STUDY .....	45
5.3. SET-UP EXPERIENCE SAMPLING STUDY.....	46
5.3.1. EXPERIENCE SAMPLING TOOL .....	46
5.3.1.1. Content.....	46
5.3.1.2. Notifications .....	48
5.3.1.3. Data Collection .....	48
5.3.1.4. Participants.....	50
5.3.1.5. Procedure .....	51
5.4. EXPERIENCE SAMPLING STUDY-ANALYSIS .....	51
5.4.1. RESULTS .....	52
5.4.1.1. Notifications .....	52
5.4.1.2. Content.....	54
5.4.2. CONCLUSIONS: INTERVIEW SESSIONS .....	58
5.4.2.1. Content.....	58
5.4.2.2. Notifications .....	59
5.4.3. DISCUSSION OF EXPERIENCE SAMPLING STUDY.....	60
5.5. DESIGNING AN ESM TOOL FOR DESIGN EDUCATION.....	61
5.5.1. GUIDELINES: ASSISTING STUDENTS' SELF-REPORTING ACTIVITY .....	62
5.5.2. GUIDELINES: MONITORING THE STUDENT EXPERIENCE.....	63
5.5.3. GUIDELINES: DATA COLLECTION.....	66
<b>6. CONCLUSIONS .....</b>	<b>68</b>
6.1. INTRODUCTION .....	68

6.2. REFLECTING ON RESEARCH QUESTIONS .....	68
6.3. LIMITATIONS OF THE STUDY.....	71
6.4. FURTHER RESEARCH.....	71
6.4.1. RECOMMENDATIONS FOR DESIGNERS .....	71
6.4.2. RECOMMENDATIONS FOR RESEARCHERS .....	72
<b>REFERENCES .....</b>	<b>73</b>
<b>APPENDICES .....</b>	<b>76</b>
A: Results of Journey Mapping Session from 1 <sup>ST</sup> and 2 <sup>nd</sup> Round .....	76
B: Diary Used in Study 2 .....	81
C: Activities, Feelings, Reasons Mentioned in Diary and Interview in Study 2.....	86
D: Explanations Associated with Two Visual Instruments for Reporting Affective Experiences in Study.....	91
E: Invitation Poster for Experience Sampling Study .....	94
F: Number of Responses Based on Day and Week .....	95
G: Characteristics of Keywords .....	97

# LIST OF FIGURES

## FIGURES

Figure 1.1 Illustration of a possible scenario: Student’s reporting activity of his own design project experiences regularly .....	2
Figure 1.2 Structure of the Thesis.....	5
Figure 2.1 My Experience Software .....	7
Figure 2.2 Relationship between functionality of ESM tool and availability of technology ...	8
Figure 2.3 Care Net Personal Health Monitoring System.....	9
Figure 2.4 Feedback system to measure participant’s compliance in ESM study.....	10
Figure 2.5 Embedded Empathy in ESM Tool.....	10
Figure 2.6 Visual feedback represents individual’s transportation habits .....	11
Figure 2.7 Image-based data collection for studying physical space and behavior .....	12
Figure 2.8 Illustration of four main design criteria in relation to self-reporting and monitoring in an ESM tool.....	13
Figure 3.1 “Insights and Opportunities Board” that is used in Fuzzy Front End by design students .....	16
Figure 3.2 Example from mind-mapping exercise .....	16
Figure 3.3 Snapshots from a tinkering session.....	17
Figure 3.4 Screenshot from Design Surfer Tool .....	18
Figure 3.5 Example screenshot from the website of Blackboard Inc.....	19
Figure 3.6 Example screenshot of an online blog posting.....	20
Figure 3.7 Example screenshot from Blackboard Collaborate Tool.....	21
Figure 3.8 Example page from a cultural probe workbook for design students .....	22
Figure 4.1 Focus of explorative studies: Reporting the student experience based on four main dimensions .....	26
Figure 4.2 Summary of interrelation between three explorative studies.....	27

Figure 4.3 Example of Customer Journey Map.....	28
Figure 4.4 Worksheet Prepared for Journey Mapping Sessions .....	28
Figure 4.5 Example of a worksheet resulted from the journey mapping session.....	29
Figure 4.6 Stages of design activities that are defined by students for the time period in between two supervisory meetings.....	30
Figure 4.7 The influence of previous activity on student’s present experience .....	32
Figure 4.8 Reasons for mood transition in student experience .....	32
Figure 4.9 An example page from the first part of online diary .....	34
Figure 4.10 Example page from the second part of the online diary .....	34
Figure 4.11 Pictorial Mood Reporting Instrument.....	39
Figure 4.12 Example page from the booklet .....	40
Figure 4.13 Suggested model for content of ESM tool evaluated in main study.....	43
Figure 4.14 Suggested notification times for ESM tool evaluated in main study .....	43
Figure 5.1 Focus of experience sampling study.....	45
Figure 5.2 Content of experience sampling tool.....	47
Figure 5.3 Mood characters that are used in experience sampling study .....	48
Figure 5.4 Individual surveys that is created for experience sampling study .....	49
Figure 5.5 Screenshot from the database of online survey tool.....	49
Figure 5.6 Screenshot from an e-mail reminder that students received during experience sampling study .....	50
Figure 5.7 Illustration of data collection in experience sampling study .....	50
Figure 5.8 Distribution of participants according to project teams .....	51
Figure 5.9 Number of responses .....	53
Figure 5.10 Number of responses from each participant .....	53
Figure 5.11 Number of responses throughout the day .....	54
Figure 5.12 Distribution of six main characteristics of reports .....	55
Figure 5.13 Distribution of characteristics according to three main categories .....	56
Figure 5.14 Content of an ESM tool for design education.....	62

Figure 5.15 Mood reporting as part of content of tool .....	62
Figure 5.16 Relationship between privacy and engagement criteria in an ESM tool for design education.....	63
Figure 5.17 Student’s reporting activity based on five main characteristics .....	64
Figure 5.18 Illustration supervisor’s activity of monitoring student experience .....	65
Figure 5.19 Relationship between compliance and adjustability in ESM tool for design education.....	66
Figure 5.20 Illustration of Data Collection with ESM tool.....	67
Figure A1. Journey Mapping Diagram: Participant 1 .....	76
Figure A2. Journey Mapping Diagram: Participant 2 .....	77
Figure A3. Journey Mapping Diagram: Participant 3 .....	78
Figure A4. Journey Mapping Diagram: Participant 4 .....	79
Figure A5. Journey Mapping Diagram: Participant 5 .....	80
Figure B1. Online Diary: Page 1 .....	81
Figure B2. Online Diary: Page 2 .....	82
Figure B3. Online Diary: Page 3 .....	83
Figure B4. Online Diary: Page 4 .....	84
Figure B5. Online Diary: Page 5 .....	85
Figure E1. Poster prepared for invitation to Experience Sampling Study.....	94
Figure G1. List of keywords: Page 1.....	97
Figure G2. List of keywords: Page 2.....	98
Figure G3. List of keywords: Page 3.....	99
Figure G4. List of keywords: Page 4.....	100
Figure G5. List of keywords: Page 5.....	101



# LIST OF TABLES

## TABLES

Table C1. Online Diary Results: Page 1.....	86
Table C2. Online Diary Results: Page 2.....	87
Table C3. Online Diary Results: Page 3.....	88
Table C4. Interview Transcript: Page 1.....	89
Table C5. Interview Transcript: Page 2.....	90
Table D1. Booklet Diary Results: Page 2.....	91
Table D2. Booklet Diary Results: Page 1.....	92
Table D3. Booklet Diary Results: Page 3.....	93
Table F1. Number and frequency of responses: Page 1.....	95
Table F2. Number and frequency of responses: Page 2.....	96

# CHAPTER 1

## INTRODUCTION

### 1.1. BACKGROUND AND THE NEED FOR THE RESEARCH

Unlike other disciplines, industrial design education strives for more than teaching “how to design”. In design schools, students are trained for discovering their skills, values and translating them into their own design visions as future designers. Traditionally, design projects start with a design brief that involves a clearly stated problem (Design Council, 2012). Whilst working on their projects, students perform design activities and discuss their work with their project supervisors or course tutors in regular meetings. During these meetings, supervisors evaluate students’ progress and provide feedback for the work presented by them. Students then continue working and respond to the provided feedback.

Sometimes, students may encounter problems (e.g. not knowing what or how to do next) while working on their projects. In fact, the guidance provided by supervisors would be more useful if they are able to understand what is going on in student’s mind in between two consecutive meetings. If the supervisors can understand students’ needs, at what point of designing they struggle or which skills they need to develop, then they can help students better.

In order to understand the nature of these guidance problems during supervisory meetings better, an initial investigation was conducted by the author. It involved discussions with two design project supervisors involved in postgraduate level teaching at Industrial Design Engineering Faculty of Delft University of Technology (DUT). Additionally, personal experiences and observations made by the author during supervisory meetings supported the insights obtained from discussions.

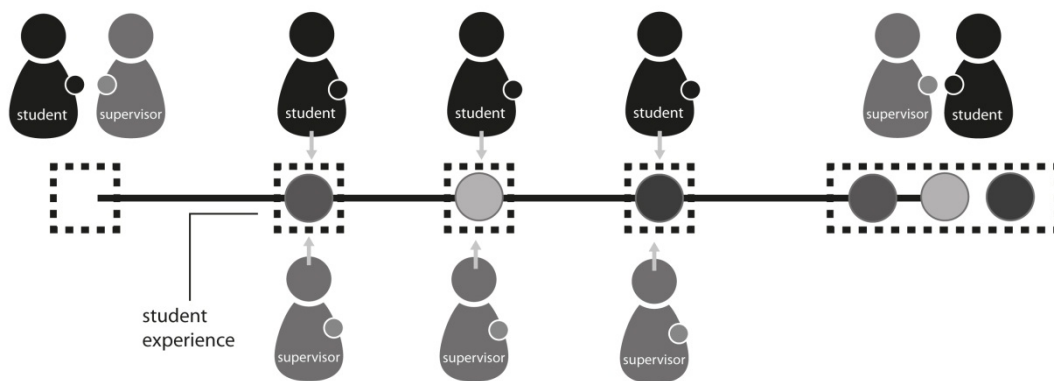
Accordingly, during supervisory meetings, project supervisor and student get together in order to discuss what activities the student carried out, whether he/she successfully progressed or failed for some reason, and why. During the meetings, discussion is made over the materials that students present using various media (e.g. sketches, notes, screenshots from computer generated drawings, mock-ups), which help supervisors to understand the content of the design activities. However, although these materials are useful to illustrate the student’s design progress and reveal the activities he/she carried out, they do not explicitly help supervisors to understand where the student experienced difficulties and how they could (or could not) make a specific decision, hence experienced having ‘stuck moments’ (i.e. a period of time that the student was not able to progress due to not knowing what or how to do). For example, one supervisor explains that in the meetings, students are always asked to start with explaining their whole process in one minute. This, he continues, “helps students and myself to illustrate the big picture and allows us to discuss their decision making more easily.”

On the other hand, students may also find it difficult to recall and explain their step-by-step actions retrospectively, since there would be a time gap between the activities they followed in between the supervisory meetings. Therefore, it is important for students that their supervisors can identify the cause of a certain problem or a chain of problems leading them to ‘stuck in a moment’ situation. There are some applications used in order to keep frequent

track of students' activities while they are carrying out design projects. For example, in some courses, online blogs are used to report students' activities regularly. There are also educational online tools to support design projects, where the project course coordinators upload specific information related to project, students share their work with each other, or have discussions on projects (e.g. blackboard-learn tools). Such kind of tools facilitate keeping track of students' progress, usually based on reporting the design activities that are initiated, modified and updated by students themselves. Use of these tools depends on student's individual preference or motivation of expressing his/her own experiences with design projects.

### ***The Student Experience***

In design projects, how students experience the process, in other words; students' personal evaluations on what they think, or feel about their activities, would be a useful source of information for their supervisors in terms of understanding what is happening in detail, in between consecutive supervisory meetings. Similarly, providing a platform for design students to report their 'experiences' on their design projects regularly, would help them to express how they feel at certain stages of the project, helping to reveal problematic and comfort situations. This way, rather than waiting until the following supervisory meeting, both the student and the supervisor would follow the progress more frequently, as illustrated in Figure 1.1. Gathering these experiences would additionally help supervisors to monitor students' progress, make interventions if necessary, as well as providing feedback on what goes wrong or good with the project thus improving the educational methods and strategies.



*Figure 1.1 Illustration of a possible scenario: Student's reporting activity of his own design project experiences regularly*

On the other hand, usually a design studio involves many students and monitoring each student's experience and progress would be a time-consuming activity for supervisors to understand the process in between supervisory meetings. During the discussions with supervisors about the possible scenario of monitoring the student experience, both supervisors mentioned they usually don't have additional time in between meetings, to communicate with students related to their process.

However, they agreed that understanding the process in between supervisory meetings would be easier by students' regular self-reporting of their experiences. On the other hand,

sharing the personal experiences (e.g. emotions, feelings, thoughts) with supervisors in an educational context could be a sensitive aspect for students while self-reporting.

### ***Experience Sampling (ESM) Tools***

There are available tools used in the fields like education or health to monitor an individual's daily life in relation to the context (e.g. time, place, activity) and personal circumstances (e.g. emotions, feelings, ideas). These tools are developed based on experience sampling method (ESM), a research method focus on collecting self-reported data from participants in order to measure their daily life experiences, especially during a long period of time. With ESM, participants are able to make evaluations about their experiences at the time they occur; this way, memory biases while re-calling a past activity or a situation is avoided.

Since the application area of ESM tools has been expanded, the design and application of tools are also specific for each context, subject matter and the target group. Although there are generic specifications that are part of the ESM methodology itself, (e.g. interruption, motivation for compliance) the design and use of these tools are studied and developed by researchers from fields such as design or human-computer interaction. In this sense, monitoring the student experience in between two supervisory meetings based on student's self-reporting, could be investigated by using an ESM tool throughout the design projects that is specifically developed for the context of design project.

## **1.2. AIM OF THE STUDY**

The aim of this study is to reveal insights on assisting design students to report their experiences during design projects, hence, help them to illustrate their process in between supervisory meetings in detail to understand what goes well or bad with the project. In this sense, this study focuses on creating guidelines to design tools for reporting and monitoring the student experience based on student's self-reporting.

Applying experience sampling method on a tool that students report their experiences regularly, would provide in-depth data to evaluate the features of the tool that is used by students during design projects. On the other hand, in order to carry out an experience sampling study, preliminary studies needs to be carried out, to firstly define the main characteristics of experience sampling tool which specially aims to capture the student experiences in design projects.

Accordingly, main and supporting research questions are as follows.

**Q.1.** What are the dimensions of reporting the student experience during design projects?

**Q.1.1.** To what extent are the capabilities of available tools satisfactory/unsatisfactory in terms of reporting students' experiences?

**Q.1.2.** How can design students be assisted to report their experiences regularly throughout design projects?

**Q.2.** How can design students' reporting activities about their experiences be monitored throughout design projects?

**Q.2.1** What are the main features of existing experience sampling tools that aim monitoring individuals' daily life experiences?

### **1.3. STRUCTURE OF THE THESIS**

The presented study consists of six main chapters (Figure 1.2). Chapter 1 opens with the problem definition, followed by research aim and questions, and structure of the thesis.

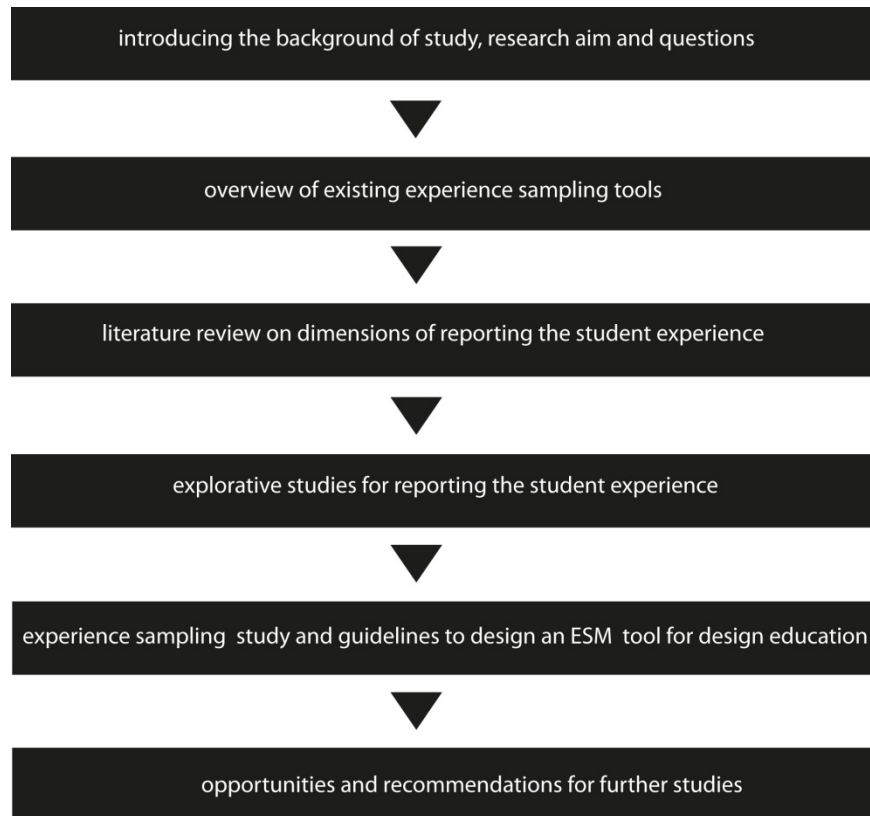
Chapter 2 presents literature review that starts with an overview of existing experience sampling tools, their main features and applications in order to assist individuals' self-reporting and monitoring activities. Chapter concludes with the list of main requirements for designing an ESM tool.

Chapter 3 presents dimensions of student experience; design students' learning experience during design projects based on design activities. It continues with discussion on existing tools for reporting and monitoring student experience during design projects.

Chapter 4 presents three interconnected explorative studies that intends defining the main features of the ESM tool that is specially used in design projects. It starts with the methodological approach for the explorative studies, continues with results of each study. Finally, it offers the list of main features of ESM tool that is applied as the main study in Chapter 5.

Chapter 5 presents the main study. It involves evaluating the main features of ESM tool, with an experience sampling study that continues with interviews. It ends with the conclusions, presented as the guidelines for designing an ESM tool that would be used by design students and supervisors during design projects.

Finally, Chapter 6 revisits the research questions, draws conclusions for the presented study and sets up a background for designing ESM tools used in design education, by discussing the limitations of the study and presenting recommendations for further research.



*Figure 1.2 Structure of the Thesis*

## **CHAPTER 2**

### **EXPERIENCE SAMPLING TOOLS AND APPLICATIONS**

#### **2.1. INTRODUCTION**

In order to describe the main features and strategies while developing experience sampling tools, and to create a clear understanding of how they are applied for monitoring individual's daily life experiences, this chapter provides an overview of existing ESM tools and their applications. First, it starts with a brief explanation of experience sampling method, its origin and first applications. After that, it illustrates the main features of ESM tools, based on contemporary use and applications, followed by the list of main requirements while designing ESM tools.

#### **2.2. EXPERIENCE SAMPLING TOOLS**

Experience sampling originated in clinical psychology during 1980s and has been applied in the studies to collect self-reported data from individuals during a long period of time. This way, researchers were able to collect fresh experiences by sampling them at the time when they occur. It was possible to monitor the fluctuations of participant's everyday experiences; the link between external and internal coordinates of experiences, hence the relationship between the inner thoughts, ideas and feelings between the physical space, such as the time, location or certain activities (Csikhemihalyi et al., 2007). Following its first applications in psychology field, the method started to be applied in research studies that are related to monitoring individual's daily life, based on their personal self-reported experiences. In fact, experience sampling does not refer a single type of data collection method. Scollon (2009) points out three main types of experience sampling. Accordingly, the first one, interval-contingent sampling collects the data according to a specific time interval; event-contingent sampling collects data when a specific event happens; and the last one, signal-contingent sampling collects the data based on prompting participants in randomly defined times. Nowadays, experience sampling methodology is implemented into several research areas that are interested in monitoring specific activities, behaviors or well-being of individuals during their daily life. Accordingly, different applications of experience sampling studies lead researchers to improve the design of ESM tools according to the focus of data collection. Therefore technical requirements for the data collection gain importance.

##### **2.2.1. DATA COLLECTION AND SELF-REPORTING**

Since experience sampling method collects data as part of participant's daily life activities, the technical configuration to manage the data collection and self-reporting questionnaires became the essential aspects of developing ESM tools. During the studies, participants usually carry a device to answer regular questions, thus, mobile devices are part of experience sampling studies.

To arrange the number and frequency of notifications adjusted for different type of questions, the software applications were developed such as My Experience software (Figure 2.1). My Experience, developed by Intel Research, allows researchers to collect sensor-based location information combined with self-report data on a user's cell phone, thus it provides both objective and subjective data collection (Froehlich et al, 2007).



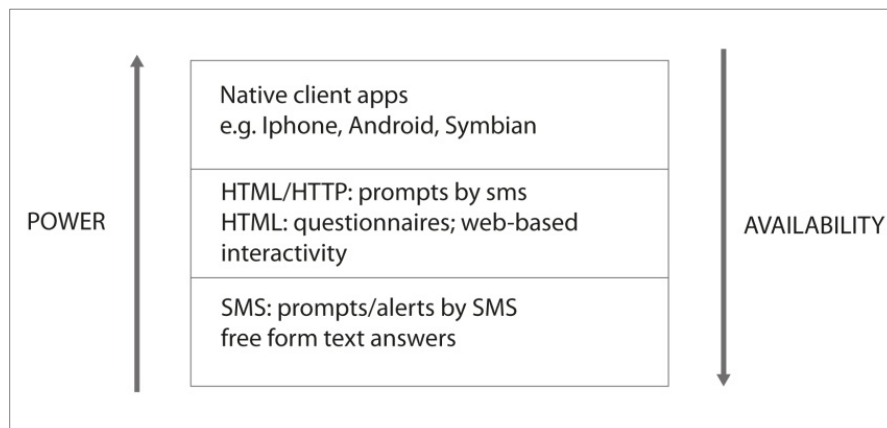
Figure 2.1 My Experience Software

Similarly, Context-Aware Experience Sampling (CAES) was developed by MIT, which is based on triggering the notifications by using context data that is captured by sensors. With this technique, participants' reporting activity is initiated by the context data, such as location, time, event or biosensor data (Intille, 2003). It is also applied in studying and designing the ubiquitous technologies, in order to monitor individuals' interactions with specific technologies.

During the experience sampling studies, it is important for researchers to operate data and set-up of the study, in order to recover the problems as they occur during the study. For example, Adaptive Experience Sampling (Vastenburg et al., 2010) is developed in order to support the troubleshooting and making interventions during the use of experience sampling tool. It addresses developing tools to enhance experience sampling studies by allowing researchers to observe the initial use, context, and adapt the questions accordingly.

Based on his review on existing ESM tools, Fischer (2009) states that as functionality of an ESM tool increases, the availability of the required technologies decreases. He explains the relationship between power and availability as illustrated in Figure 2.2.





*Figure 2.2 Relationship between functionality of ESM tool and availability of technology  
(Adapted from Fischer, 2009)*

Before applying the real technology, researchers use Wizard of Oz style evaluation techniques in order to test if content or form of questions are perceived and responded sufficiently by the participants.

For example, in Consolvo's study, (2007) a personal health monitoring system that is called CareNet, which consist of a touch screen tablet PC located in a wooden frame is evaluated firstly with a Wizard of Oz technique (Figure 2.3). In this system self-reports are initiated by researcher instead of the sensors, and the information is updated.

This way, researchers are able to adjust or revise the content of questions based on participants' preferences by making interviews afterwards, and developing the design of the tool before applying the actual working technology.

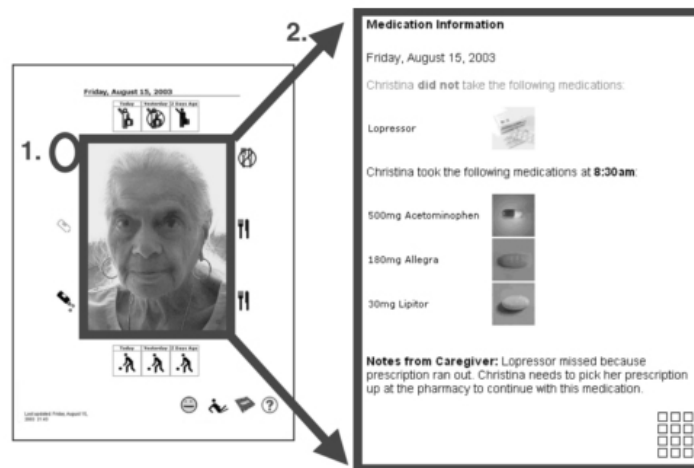


Figure 2.3 CareNet Personal Health Monitoring System

In fact, use of technology while designing ESM tools depends on in what kind context and by what kind of target group the ESM tool is used. While monitoring individuals' experience in relation to a specific activity (e.g. location change, using a product), the requirements of data collection are defined based on the context of activity. On the other hand, self-reporting in long term requires specific features for ESM tools to motivate individuals for self-reporting about their experiences.

### 2.2.2. MONITORING PERSONAL DATA

The main strategies for developing ESM tools involve optimizing the quality of sampling by minimizing the interruption (to avoid frustration while responding the questions in daily life) and by keeping participant's motivation high (to create the engagement and increase compliance in long term studies) (Intille, 2003; Scollon, 2009; Vastenburg, 2010). By addressing these strategies, both self-reporting and monitoring the data is facilitated. To provide a brief overview on what features are involved to address these main strategies, some examples from existing studies are illustrated as follows.

During the experience sampling studies, self-reporting is usually triggered by notifications. (e.g. via SMS) These notifications ask participants to stop his/her current activity and answer the questions. In order to increase the motivation of participants during ESM studies, researchers have been improving data collection or feedback techniques. For example, in Hsieh's study (2008), participant's compliance in long term was investigated by providing visual feedback to participants as they respond the questionnaires related to software which was installed in their computers. According to their observations, receiving regular feedback increased participant's compliance (Figures 2.4).



Figure 2.4 Feedback system to measure participant's compliance in ESM study

Another motivational aspect is applied in Liu's study (2004), which investigates long term interactions in health assessment system; purpose of the study is to monitor patients' physiologic signals such as insulin level of diabetic patients or stress level. Therefore they implemented an empathic interaction into ESM tool, to keep people engaged and to increase their motivation for regular self-reporting during a long period of time (Figure 2.5).

```

S: Morning, Jane!
S: Do you have a minute?
U: Yes.
S: You know the drill -- feeling stressed?
U: Its there - but not the worst.
S: Wish it was better. Hope things start looking up.
S: Thanks so much for all your input.

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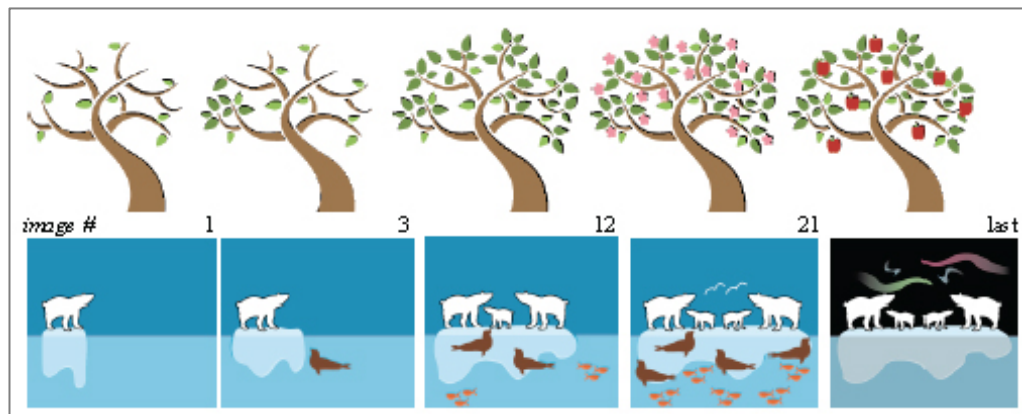
S: Morning, Jane!
S: Do you have a minute?
U: Yes.
S: You know the drill -- feeling stressed?
U: Its there - but not the worst.
S: Thanks so much for all your input.

```

Figure 2.5 Embedded Empathy in ESM Tool

Experience sampling tools are also used for studying user experience research in human-computer interaction, especially for evaluating the design implications of personal

monitoring systems and their future applications. For example, in “UbiGreen” project, Froehlich (2009) investigates individual’s green transportation behavior. Aiming at developing an application for creating an awareness of sustainable transportation habits, they create visual representations for the collected data based on participants’ transportation behaviors (Figure 2.6).



*Figure 2.6 Visual feedback represents an individual's transportation habits*

Researchers apply alternative sampling methods to reduce the interruption while responding the notifications received from an ESM tool. For example, in Mancini’s study (2009), they investigated mobile privacy in terms of monitoring people’s interaction with social networking applications. Their method consists of sampling context-dependent memory phrases from participants, to be later on used in interviews.

In order to sample the daily life activities, they integrated the questions in a social network system, Facebook application. This way they reached participants daily life activities while they provided questions related to actions in Facebook, such as status change, their location and activities. Intille (2003) used an image-based experience sampling to collect data about participants’ physical space and behavior. Sampling was based on capturing the picture. These collected images were evaluated by participants in terms of the captured activity and the relationship with environment (Figure 2.7).

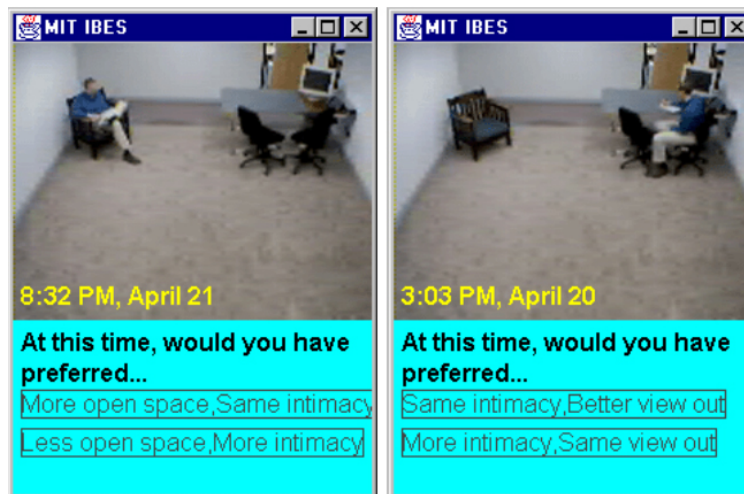


Figure 2.7 Image-based data collection for studying physical space and behavior

### 2.3. CHAPTER DISCUSSION

Generally speaking, an “ESM tool” supports carrying out experience sampling studies; it allows researcher to collect data, manage the type and number of surveys that sent participants to do self-reporting. The tools such as My Experience have flexible characteristics to collect data in different context and during different activities. These tools offer technical features to address mobility of individuals during daily life experiences. Different technologies such as GPS (e.g. location related studies) or sensors (e.g. physical activity related studies) can be implemented in these tools during experience sampling studies.

The changing characteristics of ESM tools are closely linked to what type of personal experience is collected and monitored. (e.g. UbiGreen, CareNet) Regarding to different types of experiences, (e.g. physical activity, transportation habits) the technologies such as mobile phone applications or social media platforms are part of the experience sampling studies. Therefore, according to the activity of interest, the content (e.g. form of questions) and type of notifications (e.g. signals by researchers, context dependent triggering) shows variety. In this sense defining the content and notifications becomes important before developing the actual prototypes. However availability of the technologies is sometimes limited and application of ESM might be cost and effort demanding.

Based on the requirements of methodology, there are specific strategies that are considered while developing the experience sampling tools. Enhancing individuals’ motivation for self-reporting is one of these strategies. One of the aspects for motivating participants’ is to enhance the engagement with tool and involve the participant into the monitoring process.

In this case, what participants report and how they report plays important role for engagement. Besides that, when participant has to stop and respond the notifications, self-reporting activity might interfere with participants’ daily life flow when self-reporting activity repeats every day. Therefore, data collection mechanisms and form of notifications (image based sampling, SMS) are also important to enhance participant’s compliance in long term. Taking the contrary approach, “being monitored” by someone else, also might create privacy issues with participants. In existing applications, according to the interest of

research, participants use ESM tools in their private life, such as in houses (e.g. CareNet) or while visiting different places (e.g. UbiGreen). Therefore while developing ESM tools researchers should consider data collection methods in terms of participants' willingness for sharing their personal data. Similarly, another aspect from researchers' point of view is monitoring the initial use of experience sampling tools. Being able to make interventions while participants use the tools, such as in adaptive experience sampling, provides opportunities for improving the content and design of tools. Therefore the adjustability of questions provides opportunity to overcome the unexpected results in long term.

Overall, while designing ESM tools for specific context and target groups, it is important to consider the factors that influence self-reporting and monitoring activities. Based on the existing examples, content and notifications are determined for each specific study, according to the interest. However, in order to improve the design of the ESM tool, there are criteria that address both participants' and researchers' needs and concerns while using the tool. Based on the discussions, **engagement, compliance and privacy** should be considered in terms of enhancing the self-reporting activity. **Adjustability** should also be considered in order to allow improvements and configurations in long term. In this sense, content and notifications of ESM tool should also address these four criteria, as illustrated in Figure 2.8.

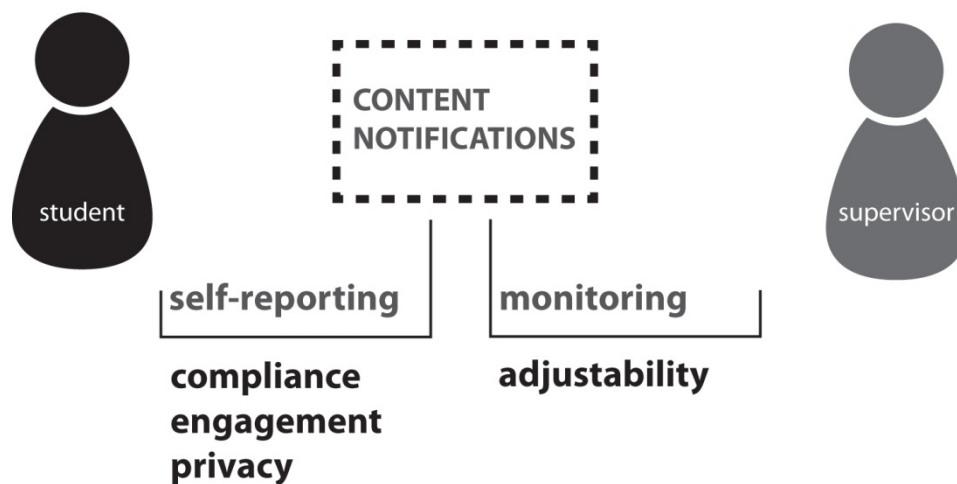


Figure 2.8 Illustration of four main design criteria in relation to self-reporting and monitoring in an ESM tool

## CHAPTER 3

### REPORTING 'STUDENT EXPERIENCE' DURING DESIGN PROJECTS

#### 3.1. INTRODUCTION

In order to report the student experience, there should be a good understanding of dimensions of student experience, and how these dimensions take place student's self-reporting on his/her experiences. (e.g. how student think and report that he/she has a bad or a good experience) Accordingly, this chapter discusses how the design student experiences the design project in industrial design education. First section describes students' learning experience during design projects and continues with elaboration on design activities as the core aspect of design students' learning experiences. Second section addresses the affective experiences of design students. It discusses reporting the design activities in relation to affective experiences, by focusing on existing tools for self-reporting in educational contexts.

#### 3.2. DESIGN PROJECTS AND STUDENT EXPERIENCE

IDSA (Industrial Designers Society of America, 2010) describes industrial design as: "Industrial design (ID) is the professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer." In contemporary design education, educating innovative designers has been gaining importance; students are dealing with more complicated issues which require a knowledge synthesis of form giving, manufacturing, consumer behavior etc. (Lugt et al., 2004).

Similarly, Stappers (2007) clearly points out the skills of industrial design students as future designers. He states that:

"They can communicate with all specialisms and specialists involved; they can integrate the (often mismatching) inputs from specialisms; they can act in the absence of complete information; they retain focus on the realizing the product throughout the process." (p. 83-84)

Traditionally, one important characteristics of design learning is that, design is 'learnt by doing' rather than reading or listening somebody who is explaining what designing is (Lawson, 2004; Dorst et al., 2004). Similarly, various studies have been focused on design students' learning experience by emphasizing the qualities of designing. For instance, Christiaans (2011) studies students' awareness of their own design process focusing on students' evaluation on their activities (e.g. identification of problem, research, brainstorming, and sketching, modeling, prototyping) in relation to four phases of design process; initial/conceptual, development, detailing, pre-production. Chen (2011) mentions design students' learning problems in relation to concept generation, organization and structure of design documentation, physical model-making and selection of the design direction in the design research phase.

### **3.2.1. DESIGN ACTIVITIES**

Several authors have argued designing is, in a way, an activity of problem solving, however, the problem statements which are involved in design briefs are “ill-defined” and requires additional cognitive processes than only “solving problems” (Lawson, 2004; Dorst, 2004, Eastman, 2004). For example, Cross (2001) describes designing as an unusual ‘problem solving’ process and he describes three main areas within process of designing: formulating the problem, generating solutions for problem, and finding strategies for the process.

In several studies designing is considered as a human activity which involves cognitive, as well as emotional process; during design projects students interact with their environments in different ways with different types of activities (e.g. thinking, drawing, discussing).

Dorst (1997) explains “core design activity” as deciding what kind of action needs to be taken and what the content of action needs to have. These actions require cognitive abilities, where students think, analyze, synthesize and create ideas. Also these actions involve meta-cognitive abilities, such as reflecting, thinking about the process and decision-making about the strategies (Christiaans, 2011). Designing involves explicit and practical actions which can be externally perceptible (Pedgley, 2007). To communicate the implicit and cognitive activities with outer world, students use drawings, models and other visual materials. These visual materials are basically the external representations of the mental activities (Eastman, 2001). Additionally, designing involves a social aspect. Lawson (2004) states that designing is a collaborative business; therefore communication skills also play role how student experience a design activity.

In this manner, design student’s activities are discussed based on what type of cognitive processes these activities involve, and what type of representations (e.g. visual materials) and social aspect (e.g. brainstorming) are involved in these cognitive activities.

#### **3.2.1.1. ‘In Process’ Activities**

As it is pointed out in studies related to cognitive aspects of designing (Cross, 2001; Dorst, 1997), there are multiple iterations and divisions during the designing process. Design students go through several stages while solving a problem. As mentioned in Craig (2001) and Cross (2001), problem formulation is a primary approach in design process to clarify ‘ill-defined’ problems in design briefs, where designers identify or re-define the goals, requirements and conditions of the present design problem. The studies in design education indicate that novice designers use similar methods as design experts in order to gain the skills for identifying ill-defined problems. For example, in Wormald’s study (2010), it is discussed that new product development requires a complicated problem identification process in the beginning, which is also described as fuzzy front end, and it creates a need that design students go through an explorative research and analysis phase. One of the materials that students use in this process is ‘insights and opportunities’ board, which is illustrated in Figure 3.1.



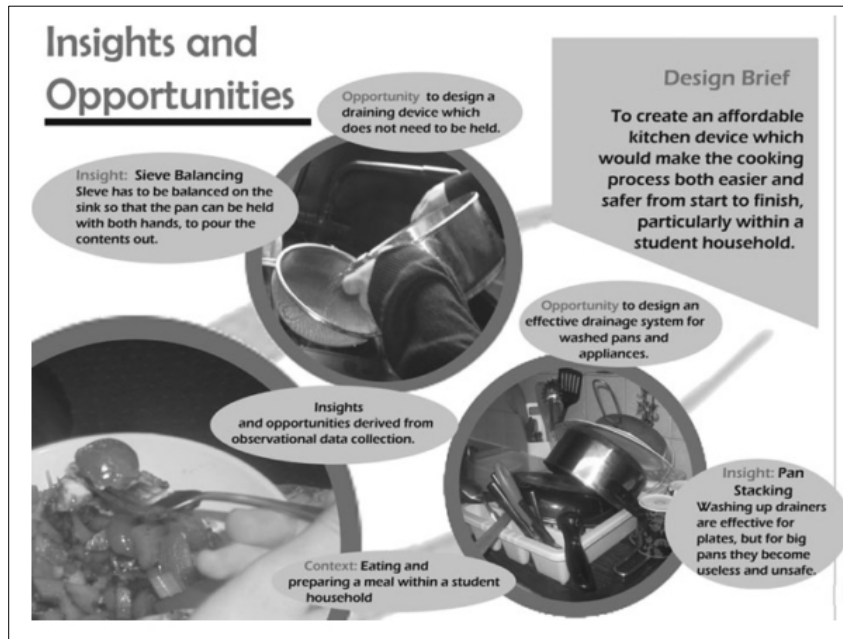


Figure 3.1 "Insights and Opportunities Board" that is used in Fuzzy Front End by design students (adapted from Wormald, 2010)

Similarly, in Kokotovich's study (2004), the methods and strategies that students use in problem analysis stage is discussed with a case study where students practiced mind mapping technique in problem analysis stage and it is emphasized that student's understanding on iterative process of designing is supported by specific techniques that they use (Figure 3.2).

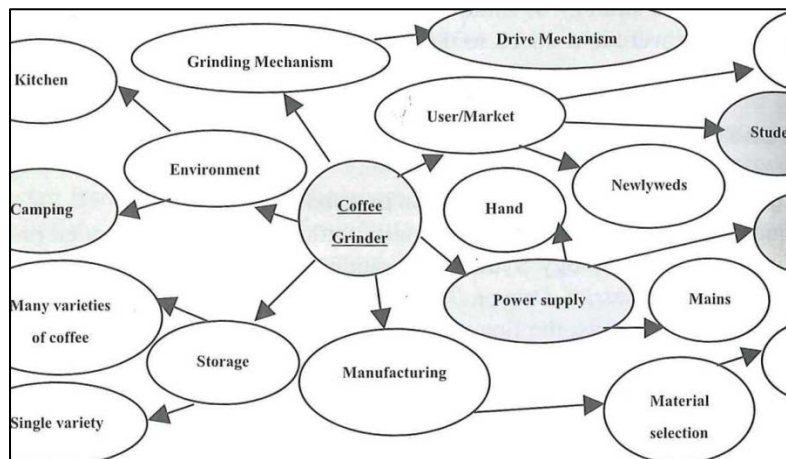
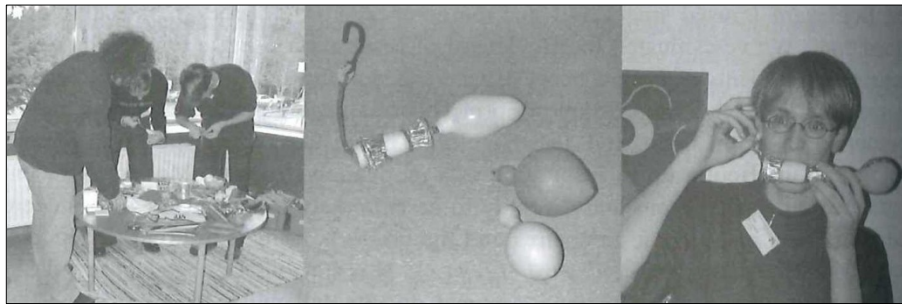


Figure 3.2 Example from mind-mapping exercise (adapted from Kokotovich, 2004)

There is also a social process in the early stage of designing. As Bucciarelli (2001) points out, in teamwork of three-four students, they share the responsibility of formulating the design task, while gathering information from different resources related to the design problem.

After the problem formulation phase, students go through different levels of design development, which basically indicates focusing into a solution. There have been several studies to observe and support students' creativity in idea generation process. For example, Newstetter's study (2001) provides the link between the brainstorming technique and creativity in idea generation phase. Brainstorming is a widely used technique in initial idea generation as well as elaborating a design idea by producing several design concepts.

For example, in Hummel's studies (2004) the use of "tinkering", a group-based brainstorming technique that focuses on creating quick prototypes with high interaction and low-fidelity qualities, was discussed in terms of its strength to enhance the imagination and creativity in ideation process (Figure 3.3).



*Figure 3.3 Snapshots from a tinkering session (adapted from Hummel, 2004)*

Visualization in design has been studied and considered an essential support to communicate the cognitive activities with outer world (Cross, 2001). One of the main representations that is used by design students is sketching. Anderson's approach (2001) for teaching drawing involves providing a pre-established perspective grid system, which encourages student to produce three dimensional drawings of his/her design ideas rapidly.

Additionally, the materials and techniques that are used for detailing the concepts and prototyping is also part of students' "in process" activities. Students use materials and tools to visualize their design concepts. For instance, Guenand's (2001) discusses using CAD software to support both early and late product development process. Ford (2001) mentions CAD software, its integration into design studio and students' effort for using CAD software to make their design representations.

### **3.2.1.2. 'About Process' Activities**

Another important cognitive aspect during the problem solving process is the student's ability of thinking and evaluating on his/her own design activities.

Schön's theory of reflective practice has been widely accepted and applied in design learning studies. Dorst (1997) explains that design students need to learn how to approach design tasks in a subjective way; which focus on learning to think about design as well as learning design.

Tschimmel (2001) gives an example of this approach in her study; she mentions that in order to enhance the meta-cognition and to support the reflection-in action, students collected their exercises in terms of what they have done what they have learned or what they have missed in terms of the problems they had during the design project.

Similarly, Christiaans (2011) also points out that students need to have a good understanding and evaluation about how various stages of designing are linked to each other and influence the entire the design process. In this manner, Humphries and Radcliffe (2001) suggest a web-based tool that helps navigate and manage the information that students need during design process. Their study show the application of the tool, Design Surfer, which is used by students to easily find the information that they need (Figure 3.4). Additionally, Humphries and Radcliffe (2001) discuss another web-based tool, which is specially used for team management in group works during design projects. The tool is called Project Web and it offers students facilities such as file sharing, scheduling, task allocation, as well as a discussion area.

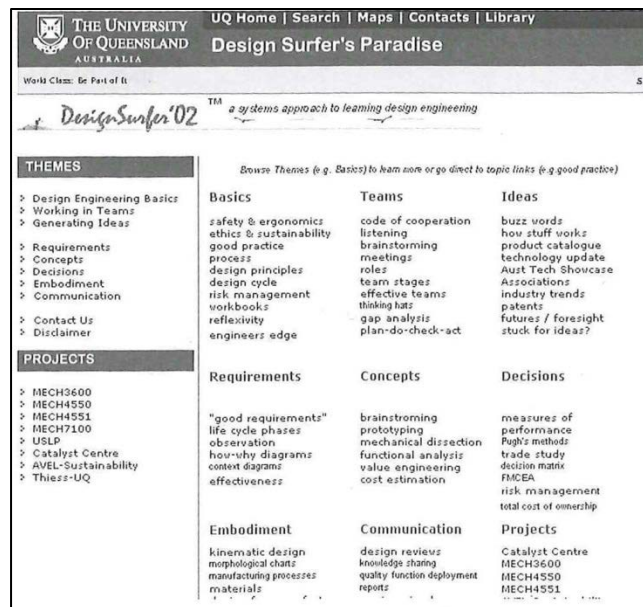


Figure 3.4 Screenshot from Design Surfer Tool

The meetings with supervisors, also plays important role in student's meta-cognitive abilities, where he/she discuss designing process in terms of the content and decision makings during several stages. According to Schön (1987) the communication between students and teachers occurs according to what students do (designing and showing the results) and how teachers give feedback (looking and evaluating the result in terms of problems and understanding of the student); the interactions during the meetings involves student's explanations of his work, evaluations, discussions and deciding for the next steps.

### 3.3. TOOLS FOR REPORTING STUDENT EXPERIENCE

#### 3.3.1. REPORTING DESIGN ACTIVITIES

There are educational tools that facilitate student's reporting of his/her activities, as well as how they feel or think about a specific activity. Blackboard is a good example for these set of tools, which are embedded on a web-based platform. Blackboard Inc. is a company that provides web-based educational service and platforms such as Blackboard-Learn, Blackboard-Collaborate, and Blackboard-Mobile (See Figure 3.5).

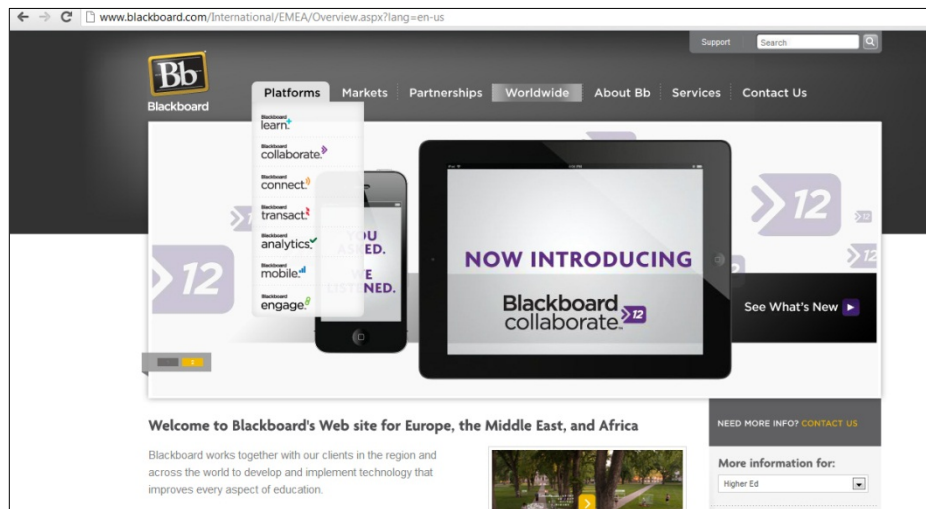


Figure 3.5 Example screenshot from the website of Blackboard Inc.

Blackboard-Learn platform involves tools for students, such as Wikis, Blogs, Journals and Discussions, which are based on regular reporting in order to support collaboration and reflection. Among these tools blogs seem to be integrated in design projects (Figure 3.5). By using online course blogs, students frequently post during design projects; they report and update their design activities. They show these activities by using different media such as pictures and movie clips as well as verbal explanations. Other students and supervisors are able to follow their progress by visiting the webpage whenever they want, share their comments about the activities. With blog posting, students are able report their activities regularly. By using online course blogs, students frequently post during design projects; they report and update their design activities (Figure 3.6). They show these activities by using different media such as pictures and movie clips as well as verbal explanations. Other students and supervisors are able to follow their progress by visiting the webpage whenever they want, share their comments about the activities. With blog posting, students are able report their activities regularly. Students do the regular reporting because it is usually part of the obligatory activities that they are introduced in the beginning of the course, so they do the reporting as part of their design project activities. The blog posts are also helpful for the documentation of what they do and help them while writing the reports at the end of the course.



Figure 3.6 Example screenshot of an online blog posting (<http://itd2011.weblog.TUdelft.nl/>)

Another aspect while reporting student experience is reporting as a group or sharing the reports with others. For example, a significant feature of the Blackboard Tools is to provide an interactive platform where students and teachers are able to conduct live sessions, as well as integrating other applications such as Microsoft Word, Excel and share the work or activities that they do. The interactive environment enhance the feedback that student get from supervisors, as well as being in contact with fellow students (Figure 3.7).

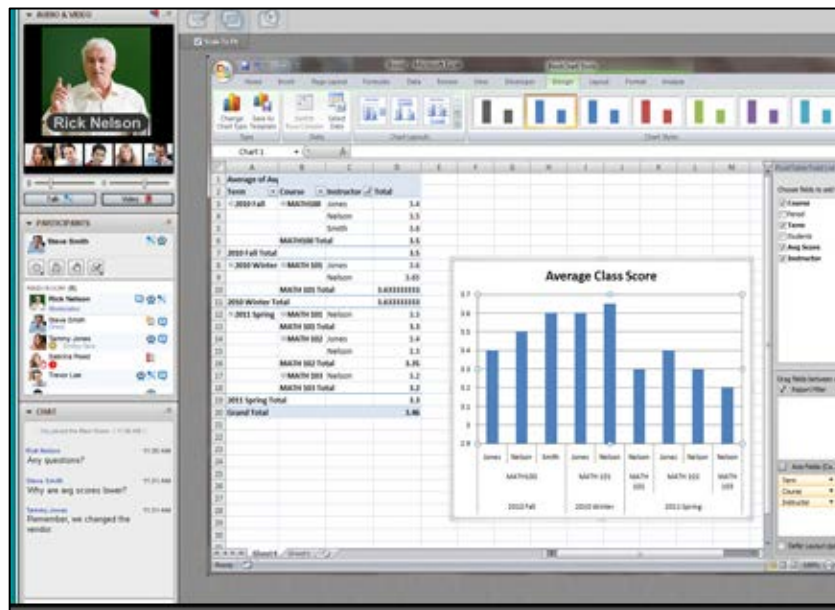


Figure 3.7 Example screenshot from Blackboard Collaborate Tool

### 3.3.2. REPORTING AFFECTIVE EXPERIENCES

Reporting about emotions, moods, feelings about design activity, has an important role to express student experience. In educational psychology, the affective experiences are part of measuring student's learning experiences, and usually evaluated in relation to motivation and cognition. In his studies, Pekrun (1992, 2002, 2006) clearly points out the "academic emotions" and explains their interrelation with student's academic motivations (e.g. achievement, self-regulation, communication). Similarly, several studies address the relationship 'between motivation', 'cognition' and 'affect' in order to measure students' experiences in educational context (Linnenbrink, 2006).

In order to build an explicit relationship with the terms affect and reporting the student experience, discussions will continue on the existing examples.

Although the affective experiences are important part of student experience, the tools that support reporting moods, emotions or feelings are limited with the questionnaire forms which ask students to express their opinions or experiences related to design activities.

A good example for reporting affective experience during design project is a booklet diary that is prepared for students' stuck moments, which is used for supporting design process of students for guidance and self-reflection. It requires an evaluation of the current situation in relation to student's past experiences and future expectations (Figure 3.8).

## This is how I deal with it...

During your design process you probably will experience moments at which you have the feeling that you're 'stuck', think of the situations you placed on the spider-legs. Can you explain your story and experiences below? This assignment can be repeated every time you have the feeling of being stuck. (every situation, also when it is no big deal, is interesting!)

MY DESIGNER'S VIEW

WHAT'S THE SITUATION?

(design activities you are currently working on)

HOW DO YOU EXPERIENCE BEING STUCK IN THIS SITUATION?

HOW DID YOU EXPERIENCE YOUR PAST WEEK?  
(in terms of your design activities)

Tip: you can use the picture set for this assignment



## My Designer's ID

MY NAME IS ...

MY BACKGROUND IS ...

THIS IS HOW I SEE MYSELF AS A DESIGNER:  
(Choose one of the icons below or draw something yourself)



I SEE MYSELF AS A .....

BECAUSE .....

.....

.....

Figure 3.8 Example page from a cultural probe workbook for design students (<https://blackboard.TUdelft.nl>)

The booklet basically focuses on student's reporting about their affective experiences in relation their design activities during design projects. With this workbook, students start with introducing their personal background and interests as novice designers, and provide an overview about their "designer identity". This workbook continues with questions and exercises which help student to describe the situation that they experience, explain their design activities and guides students to find solutions for their problems.

This workbook is accessible via the blackboard dashboard webpage where student subscribe when he/she enroll for the course. It can be printed and filled in, whenever the student feels in a stuck moment; thus it helps student to make a reflection on his/her activities. Another paper based example is the peer-feedback form that is used to make a performance evaluation of the teamwork during design projects. These evaluations are usually being performed by team members individually and then shared with other team members. This way, students are able to discuss their experience about team dynamics and reflect on their performance. Other type of forms to report affective experiences are based on surveys that are filled in by students usually at the end of project courses, in order to understand their overall experiences with the course itself.

### **3.4. CHAPTER DISCUSSION**

Design student's learning experience is based on his/her design activities in different levels throughout designing process. Design activities are continuously performed during the projects and they are based on analysis, reasoning, creative thinking, reflective activities as well as communication skills. Design representations also facilitate design activities and represent the external, communicative part of design activities. It involves the materials for communicating intuitive activities that are going on in student's mind. Communicating design activities, which represents the collaborative work with teammates as well as design conversations in supervisory meetings is also part of design activities.

The influence of supervisory meetings on the student experience afterwards depends on student's ability of evaluating his own process and make decisions accordingly. Thus, new decisions lead new strategies and ideas which influence the performance and results of activities in between the supervisory meetings. All these aspects of design activities is part of student's experience of design projects, hence his/her learning experience.

Additionally, affective experience (emotion, mood, feelings) helps students to identify how they evaluate their design activities. The affective experiences play important role while reporting on design activities (e.g. blogs) or stuck moments (e.g. cultural probe workbook) For example in the workbook, by evaluating what they feel about a certain design activity, and explaining about the reasons, students are able to reflect on their learning experience and therefore overcome the difficult moments during design projects. Also, in blog example, students involve their feelings and thoughts while they describe their design activities. Compared to workbook, affective experiences are involved in a more subtle way in blogs, however they still show how student personally feel or think about a certain design activity.

In an educational environment, students' cognitive appraisal process is based on his evaluations of interactions with his environment (activities, strategies, materials, and people) and his judgment of these interactions to achieve his goals. In this sense, student's motivation for achievement, in other words educational goals, (e.g. being a good designer, getting a good grade, having a good collaboration in teamwork) greatly influence his/her affective experience during design projects. These goals are explicitly involved in cultural probe workbook, by asking students about their "designer identity". This way, students are more aware of their personal goals about their work, and evaluate their design activities in terms of what goes good or bad and how they feel about their design project.

The affective experiences are related to design activities; however different stimuli during design activities (e.g. stress level, concentration, technical problems) influence students to evaluate the affective experiences as positive or negative. These stimuli can be related to different external factors (e.g. people, time, materials) as well as internal factors (motivation,



goals, anxiety) Therefore, a stimuli change might indicate important moments in relation to design activities, and help to understand what goes good or bad during the project.

### 3.4.1. DIMENSIONS OF REPORTING STUDENT EXPERIENCE DURING DESIGN PROJECTS

Generally speaking, “design student’s experience” is based on the learning experience, thus, it is driven by how students experience the design activities. According to the discussions, dimensions of reporting the student experience can be explained from four main aspects:

The first dimension is ***design activities***, which indicates cognitive thinking (e.g. analytical, reflective, creative thinking) students’ performances to convey different cognitive thinking during designing process. These performances (e.g. research, idea generation, modeling,) consist of visual (e.g. drawing) and social (e.g. collaborative work) dimensions. Secondly, ***student’s affective experiences*** are involved in how he/she experience the design activities. These are emotions, mood or feelings, which helps student to express the consequences of different stimuli in relation to design activities. Thirdly, the external ***stimuli*** that influence students’ performance, therefore the outcomes during design activities are part of design students’ experiences. These are different external factors, which influence student’s experience with the project in a negative or positive way. In this sense, reporting on stimuli answers ‘why’ questions, and create the link between affect and design activity. Lastly, students have ***motives***, which indicate specific goals or expectations in design projects such as being creative, problem solving, or having communication skills.

These are usually educational goals, expectations or attitudes about design activities during design projects, and explains the stimuli one step further and indicates why the stimuli is important for student and why it influenced the experience in a positive or negative way.

# **CHAPTER 4**

## **EXPLORATIVE STUDIES FOR REPORTING 'STUDENT EXPERIENCE'**

### **4.1. INTRODUCTION**

Explorative studies during experience sampling research play an important role in order to evaluate the intended use of pre-defined elements (e.g. type of questions, feedback, and frequency of notifications) with participants, by using various methods such as surveys, diaries or conducting pilot studies by using Wizard of Oz techniques (i.e. imitating the real technology manually). In previous chapters, main requirements for designing an ESM tool and dimensions of student experience is defined. Accordingly, this chapter presents the explorative studies for defining the content and notifications of tool that is used in study of experience sampling during design projects, which will be presented in Chapter 5. As the target group is defined as students, the supervisor's perspective remained out of the scope in explorative studies.

### **4.2. METHODOLOGICAL APPROACH FOR EXPLORATIVE STUDIES**

In order to explore how four main dimensions of reporting student experience (design activity, affective experience, stimuli, and motive) take place in the content and notifications of tool used in main study, specific research questions came out (Figure 4.1).

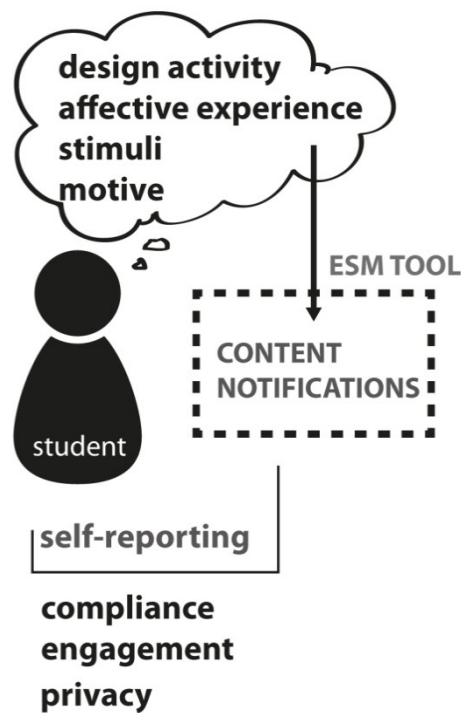


Figure 4.1 Focus of explorative studies: Reporting the student experience based on four main dimensions

Accordingly, the main research questions are as follows.

- *What should the content of tool consist of, considering the design activity, affect, stimuli and motives?*
- *What should be the frequency of reporting in relation to students' work schedule and design activities?*

In order to support the main research questions, three sub questions were also defined and explored throughout the studies, supported with students' explanations about their experiences during design projects.

- *How do students consider the benefit of self-reporting during design projects?*
- *What are the privacy concerns of students in terms of sharing their experiences with fellow students and supervisors?*
- *How the visual instruments help students to indicate positivity and negativity of their experiences?*

The exploration stage involved three interconnected studies, which focused observing design students' reporting behaviors in design projects. During the studies an iterative approach was followed. Studies were carried out by using different techniques in each three step. Illustrative summary of interrelation between three explorative studies can be seen in Figure 4.2.



*Figure 4.2 Summary of interrelation between three explorative studies*

In Study 1, students were asked to illustrate one week of design projects and discussed their explanations with the author. Main findings were used in Study 2; students were sent an online diary during 4 days, filled in and send it back to author every day. At the end of the study, students were interviewed to evaluate their reporting experience. Special focus of interview sessions were students' motivations and privacy concerns for self-reporting during design projects. Based on the main findings from Study 1 and Study 2; in Study 3 students were asked to carry a booklet diary for 8 days. They were asked to fill in the diary according to their work schedule that was indicated on each page of the diary beforehand. Special focus for Study 3 was to evaluate the visual instruments to report affective experiences during design projects.

#### **4.2.1. PARTICIPANTS**

As the studies were explorative in nature, but required in depth exploration, small group of participants were recruited for each of the three studies. They were either invited by e-mail or by direct personal communication during their design project courses. In total 15 students joined the explorative studies (5 for Study 1; 4 for Study 2; 6 for Study 3). All of the participants were selected among master students who were studying at the Faculty of Industrial Design Engineering, Delft University of Technology. Their ages ranged between 23 to 28 years with a mean of 25.

#### **4.3. STUDY 1: JOURNEY MAPPING**

The first step of explorative studies was to identify the time period in between supervisory meetings based on the relationship between design activities and affective experiences. Therefore Study 1 took the form of "Journey Mapping" which intended to explore the continuous activities and their influence on students' affective experiences in between two supervisory meetings.

##### **4.3.1. JOURNEY MAPPING SESSIONS**

'Journey Mapping' is a method which is generally known as 'customer journey mapping' and used to observe how a user goes through several stages while experiencing a product or a service. This method is valuable for observing people's daily life throughout a time period, by focusing on the significant moments of their experience and why those moments are important (Figure 4.3)

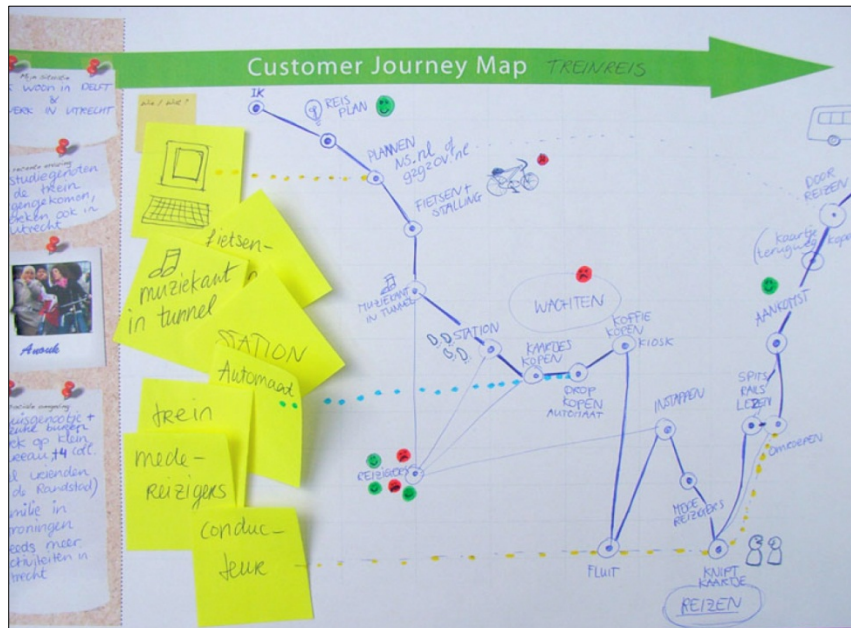


Figure 4.3 Example of Customer Journey Map (<http://www.servicedesigntools.org>)

The method is adapted in order to illustrate the relationship between affective experiences and design activities, according to students' motives and external stimuli that influence their experiences. During the Journey Mapping sessions, students were expected to illustrate the relationship between design activities and affective experiences based on a timeline in between two supervisory meetings (Figure 4.4)

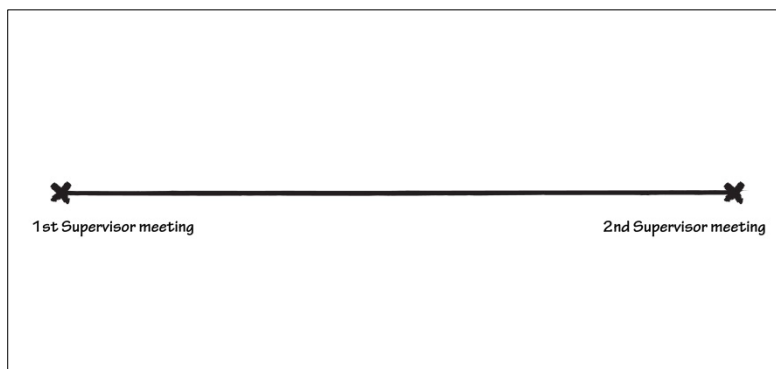


Figure 4.4 Worksheet Prepared for Journey Mapping Session

#### 4.3.1.1. Participants

Five students joined the journey mapping sessions to evaluate their design project experiences. Students received e-mail invitations and individual appointments were arranged according to their availability. Participants' ages ranged between 24 and 26. All

participants completed the project course “ID4250 Exploring Interactions” in the Fall semester of the 2011-2012 academic year, and they were asked to talk about their project experiences in relation to this course. Therefore, all participants explained their individual experiences based on same syllabus. In Exploring Interactions course, weekly meetings with course tutors were scheduled and students worked on the projects individually.

#### 4.3.1.2. Procedure

The sessions were conducted individually. Each session took around 20 minutes, including two rounds. Same procedure was followed with each student participant.

In the first round, the students were asked to recall their one week of study and talk about the stages they go through between the two supervisory meetings based on their design activities. In the second round, students were asked to explain their experiences in each stage based on their feelings, and other stimulations which they thought that had influenced their experiences with design project. They were asked to use provided worksheets and colorful markers to illustrate these stages (Figure 4.5). The worksheets recollect at the end of the sessions.

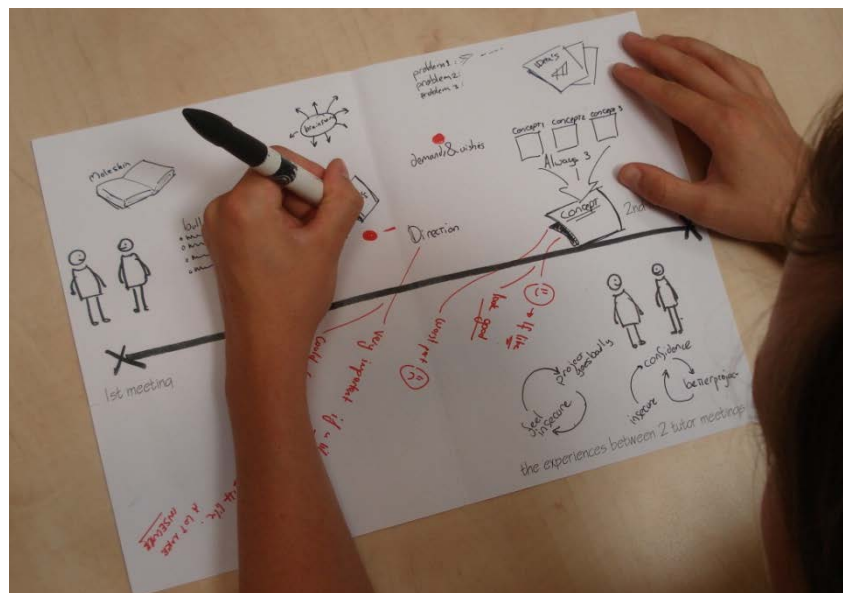


Figure 4.5 Example of a worksheet resulted from the journey mapping session

#### 4.3.2. STUDY 1 – ANALYSIS

Five worksheets were represented on a diagram for each participant, indicating the 1st and 2nd rounds (See Appendix A).

##### 4.3.2.1. Results

In the first round, students explained the stages in between two supervisory meetings based on their activities. The stages and related activities were grouped in four categories and explained as follows (see Figure 4.6).

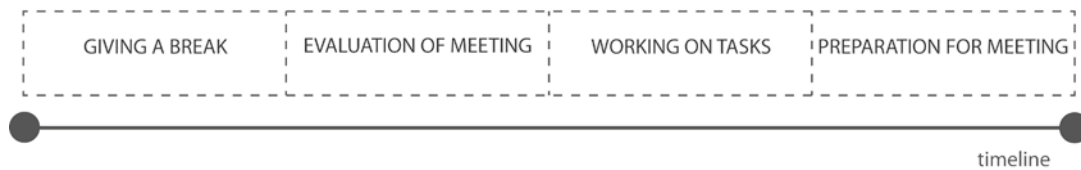


Figure 4.6 Stages of design activities that are defined by students for the time period in between two supervisory meetings

- Starting after one supervisor meeting, majority of students defined the first stage as “giving a break”. During this stage, the activities that are defined by students consist of discussions related to the feedback they got during the meetings, doing non-project related activities such as having a coffee, having a chat with friends.
- Secondly, all five students identified the stage that they evaluate the last supervisory meeting and make a planning for working. For the second phase, students defined the activities such as making bullet points, revisiting the notes taken during the meeting, creating a schedule for the tasks and planning the next activities.
- Following the planning phase, students defined the third stage as “working on tasks”. They defined this stage with the activities such as producing several ideas, brainstorming with friends for getting inspiration and deciding the direction based on their ideas.
- The last stage in between supervisory meetings is indicated as “preparation for the meeting”. The activities that students described for this stage consist of evaluating the work that they produced, deciding what to present to supervisor, and preparing questions related to the weak points that they want to improve.

In the 2nd round, students described their experiences by going through the stages that they defined. The experiences that were dispersed by students in relation to the stages are presented as follows.

- The experience of first stage, “giving a break” is associated with the supervisory meeting by majority of students. One student mentioned that she usually gets panic just after the meeting because there are so many tasks to finish until the next meeting. Another student indicated that she is comfortable during the break if the meeting went well. One of the students clarified “doing nothing” as being in a stuck moment after the meeting, when she is confused about the feedback she get in the meeting.
- During the planning stage, students evaluated the individual tasks as positive when they have a good planning about what to do next. The negative experiences were defined in the situations which are opposed to this. For example one student indicated that she is usually in a rush and stressed in order to plan everything perfectly. Another student mentioned that he tries to get motivated and do planning after evaluating the meeting.
- During the working stage, students mentioned the activities they do with their friends as well as individual tasks. All five participants mentioned that when they come together with the weekly meetings, the feedbacks they get from each other make them feel confident about their work. For example, one student mentioned that sometimes she is hesitating to attend the next supervisory meeting if she is not happy with her work; when she has a meeting with friends (e.g. discussion or brainstorming) she gets inspired again and continues working. Similarly, another student explained that these meetings are good way of comparing their own process

with others and evaluate their progress. One student mentioned that she starts working in a good mood after she made a plan.

- About the preparation stage, one of the students mentioned that preparation for the meeting is a tense experience if he is hesitant to show all the process of work and trying to decide right things to show in the meeting. Another student mentioned that she usually evaluates what has been improved since the previous meeting and what are the questions that she wants to ask. While defining the experiences with preparation stage, students mostly explained their decision making process concerning their relationship with supervisors.
- Moreover, students evaluated the supervisor meetings as positive when they are able to get guidance from supervisors according to their needs of the current stage of design process. The “good” guidance is identified as the discussion which helps them to understand what to do in the next steps. Also, supervisors’ positive attitude is ‘mentioned as a positive influence on students’ experience with supervisory meetings. Ability of motivating and inspiring the students is explained as a positive attitude. On the other hand, one student specifically mentioned that it is more important to get useful feedback from supervisor than positive and motivating attitude. Similarly, one student mentioned that he is more comfortable when he is able to express if he disagrees with supervisor. Same student characterized two roles of supervisor in design project; first one is “the person who coaches you” and the other one is “the person who grades you”.

#### **4.3.2.2. Conclusions of Study 1**

- During the Journey Mapping, students were asked to illustrate their design activities step by step on a timeline, and to associate their feelings for each step they illustrated. Students firstly defined the stages in a more broad level, and then explained more specific design activities for each step.
- When students explained their feelings associated with one stage of activity, students did not directly associate their feelings, for each stage of activity; rather they indicated that a certain feeling is usually caused by a previous or next stage. For example, when the student indicates a negative feeling (e.g. insecure, hesitant) related to a certain stage (e.g. preparation for a meeting), the reason behind it (e.g. could not complete enough work) shows that his mood is related to an activity which he defined in the previous stage. Therefore, students evaluate their experiences in relation with the previous or future activities (Figure 4.7).



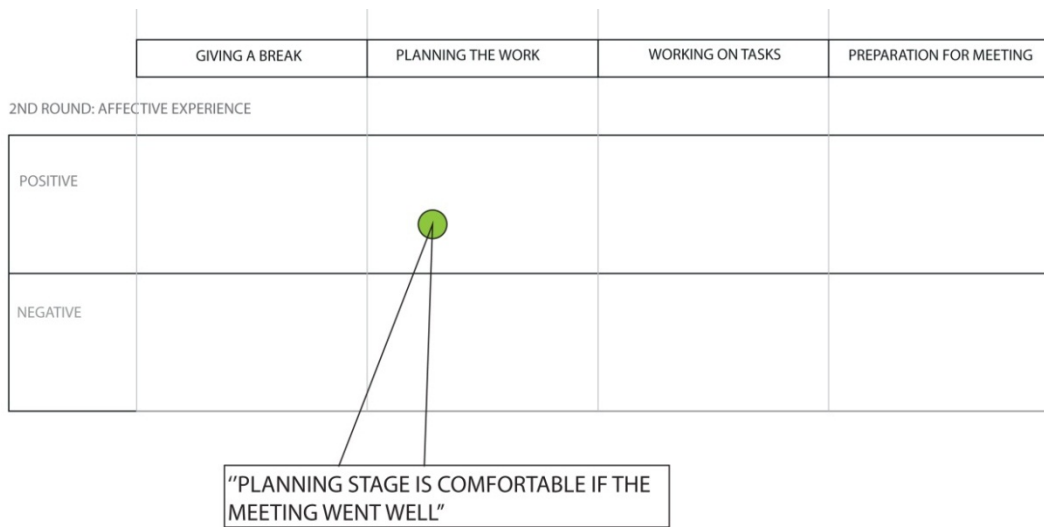


Figure 4.7 The influence of previous activity on student's present experience

- Moreover the association between design activities and affect indicated more specific activities when students explained a change in their mood during the time period in between meetings. The mood transitions indicated the relationship between design activities; a detailed explanation on what goes good or bad about design project. An example of a mood transition in one student's experience is illustrated in Figure 4.8.

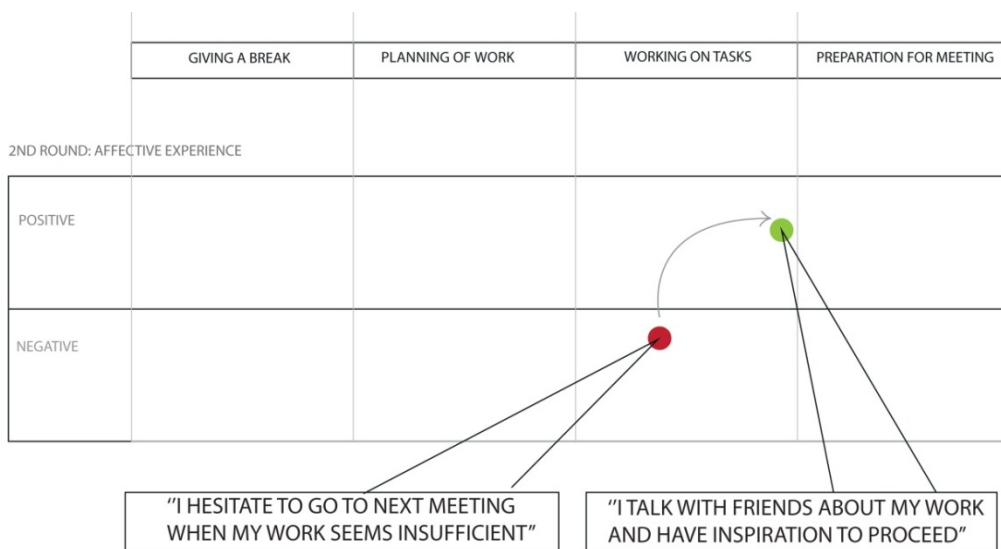


Figure 4.8 Example situation of a mood transition in student's experience

- Overall, there is continuity between design activities and the feelings of students usually indicated the outcomes from the previous design activity or an expectation about the future activity. On the other hand, reporting on mood transitions and related design activities revealed the significant stimuli change which influence students' experience in a positive and negative way. Therefore, the second study was conducted, in order to investigate reporting the mood transitions in relation to students' design activities throughout the day.

#### **4.4. STUDY 2: ONLINE DIARY**

In Study 2 the main goal was to determine the relationship between mood transition of students and design activities. Additionally, student's willingness for reporting their experiences regularly during projects was explored. Study 2 took the online diary form, which involved collecting daily reports from students about their experiences and evaluating these reports with students by discussing on them afterwards. This way it aimed to reveal insights about what factors influence student's motivation to report their experiences.

##### **4.4.1. ONLINE DIARY**

To collect participant generated information, diaries are widely used by researchers, however, verifying the information that is logged by participants creates difficulties since it completely depends on participant's behavior (Carter et al., 2005). For Study 2, an online diary was designed for students to allow them recording their experiences day by day.

The online diary was created using Microsoft Word and sent to the participants by e-mail. The diary consisted of two main sections. (See Appendix B) First section asked about students to describe one day of their design project. In order to address the design activity, affective experience, stimuli and motives, the content of the diary defined based on the *activities*, *feelings* and the *reasons* (Figure 4.6). By providing the reasons, students were expected to reveal the stimuli and motives which influence their experiences. This section involved two pages for reporting their design activities and their supervisory meetings. Second section involved a timeline which shows the day hour by hour and asks participants to indicate a significant transition in their feelings in relation to design activities during the day, in addition to how they would like to feel in the following day (Figure 4.9).

I DID...	I WAS...	BECAUSE...
Activities Planning, working, buddy meeting, nothing, brainstorming, to do list etc	Feelings insecure, confused, confident, excited, inspired, cheerful, annoyed, sad etc	Reason Why did you feel like that and why
For .....course. I am working with ..... other people in my group.		
I did some testing in the lunchbreak		
I was confident+happy Because the testing went well and it resulted in some funny situations with people I barely know so that was nice!		
I did some testing at the end of the day and we discussed the plan how to finalize this project.		
I was happy Because the end is near ☺ next to this we discussed to go to a festival on Monday with the project group, one of them will cook for us all so that will be a nice (non-project related) evening out!		
I did... I was... Because...		

Figure 4.9 An example page from the first part of online diary

09.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00
<p>9.30</p> <p>MY MOOD CHANGED FROM excited/enthusiastic TO stressed BECAUSE we underestimated the workload</p> <p>I WANT TO FEEL relaxed TOMORROW!</p>	<p>10.30</p> <p>MY MOOD CHANGED FROM stressed/pessimistic TO opportunistic BECAUSE we just had 1 hour lecture</p> <p>I WANT TO FEEL satisfied TOMORROW!</p>	<p>13.00</p> <p>MY MOOD CHANGED FROM opportunistic TO stressed BECAUSE the testing did not work out and I was too tired &amp; hungry to continue</p> <p>I WANT TO FEEL relieved TOMORROW!</p>	<p>MY MOOD CHANGED FROM ... TO ... BECAUSE...</p> <p>I WANT TO FEEL ... TOMORROW!</p>	<p>MY MOOD CHANGED FROM ... TO ... BECAUSE...</p> <p>I WANT TO FEEL ... TOMORROW!</p>								

Figure 4.10 Example page from the second part of the online diary

#### 4.4.1.1. Participants

Four MSc for Design for Interaction program students of DUT participated in the study. The participants were asked to fill in their diary at the end of the day. Therefore, each student reported according to which project they worked on during the day.

#### 4.4.1.2. Procedure

Each of the four participants was asked to fill in the online diary for four days. Every day they received a fresh diary as an e-mail attachment, and each student was asked to send the diary back after filling it in at the end of the day.

On the completion of four days, participants were individually interviewed in order to further discuss the information they provided in the second section of diary. In the interview sessions, students were given a printed version of their diary. The sessions were video recorded and each of them took approximately 20 minutes.

#### 4.4.2. STUDY 2 - ANALYSIS

Diary entries of four students and follow up interview sessions were analyzed. The results were categorized based on the reasons that students mentioned in relation to their mood transitions. The main results and examples from students' statements are presented in the following section. Full list of diary and interview quotes can be found in Appendix C.

##### 4.4.2.1. Results

- The analysis of students' diary entries resulted with 19 numbers of statements in first section and 21 numbers of statements in the second section of diary.
- Some students did not record any mood transitions but they also indicated that they did not work on the project. Additionally, the number of statements showed difference according to the students' work schedule.
- In the first section of diary, the activities that students mentioned while reporting their one day, showed diversity. Students mentioned performing many different activities at the same time. For example, in one students' report, the activities were explained as "managing, brainstorming, note taking, typing, reading, and writing". Other statements contained the activities such as work division, company visit, planning of the day, user testing. In some of the statements, students also provided more detailed explanations such as other people they work with.

*e.g.*

*"Started first assignment, didn't work out, changed the plan but not working really efficiently".*

*"I did Skype meeting with my group, we discussed about planning, task divisions, and preparing the literature research"*

- The affective experiences showed similar relationship with activities as it was observed in Journey Mapping sessions. Students usually associated their feelings, such as frustration, relief or excitement, with the activities that were expected to happen in the following days. For example, one student explained that she was annoyed because they rescheduled their meeting for next day lunch break time. She indicated that she does not like having meetings in during the lunch breaks.
- Majority of statements indicated being in a rush, stressful because of close deadlines. "Being satisfied" was associated with different aspects such as the good results, having a good plan and having a smooth process while performing design activities.

*e.g.*

*Confident/ "the group work went well and the girls are excited and enthusiastic about the project."*

*A bit frustrated/ "because no time left to test the result and being in a rush reduces the quality of work..."*

*Clear minded/ "seeing the whole image of the project"*

- Students also recorded their supervisory meetings in their diary. The explanations about supervisory meetings were similar to each other; students briefly explained what they discussed in the meetings. The reasons provided to explain the affective experiences indicated different topics that were discussed in these meetings. Students evaluated specific aspects of the feedback that they received from supervisors.

*e.g.*

*Satisfied/ "as supervisors told we were ahead of the other groups, and task execution was well managed by the group"*

*Motivated/ "finding out more details about the topic"*

- While reporting their experiences, students also indicated the times they did not work for the project. These reports provided information about project related experiences, such as communication with other teammates, or practical issues.

*e.g.*

*"Nothing; I thought we planned to do the testing this lunch-break but it happened to be tomorrow"*

*"Nothing; we rescheduled our meeting to a lunch break"*

- Based on these statements, students were asked to provide more details about their mood transitions and the reasons during the interview sessions. Overall, the reasons of students' mood transitions are illustrated in three main categories below, with example quotations from interview sessions.
- First category involves the reasons related to deciding the direction of their activities especially when the students are confused about the scope or the limits of their study. To define these goals they mostly used the keywords such as guided, capable, in control. In this category, the motivations are defined as '*knowing what to do next*'. In this category, all students mentioned their supervisory meetings and explained the significance of being confident about how to take a decision for the next step. One student explained that, when he is involved into the project too much, it becomes more difficult to see the bigger picture and take a decision accordingly. Therefore the feedback that supervisors provide was considered very valuable to support the decision-making process.

*e.g.*

*"It is good to have guidance, to know borders, because sometimes you have too many directions."*

*"I feel always more confident if the plan is clear, when there is a mess, it also becomes more stressful"*

- Second category indicates *planning and managing the project*. It expresses students' expectations related to '*getting the work done in a smooth way*'. Students mostly mentioned this category, in relation to the workload, and tight schedules to finalize the work. One student compared the individual work with group projects in terms of planning and workload. She stated that although it is easier to feel secure while

doing the group work, the progress is sometimes slower, since the arranging a time to work together requires more effort.

*e.g.*

*"I wanted to get the report done and relieve."*

*"I needed an instant feedback because I wanted to use my time efficiently."*

- Third category indicates 'be in contact' with other students while doing design activities. When students have a good brainstorming session, or discuss their work with others, this gives a more secure feeling in terms of evaluating their progress. The keywords for this category included *excited*, *secure*, and *satisfied*. In this category students mostly mentioned the activities that they perform as a group. They also mentioned that when they establish friendship as well as working together, it influences their motivation for the collaborative works in a positive way.

*e.g.*

*"I was satisfied because of nice brainstorming session."*

*"The miscommunication with teammates made me a bit frustrated."*

- Furthermore, students evaluated self-reporting as a regular activity during design projects. All students mentioned that regular reporting of activities would help them to keep track of their progress.

*e.g.*

*"It would be nice to have an agenda to write the questions that I want to ask in the meetings."*

*"I like talking about what goes wrong and specially learning the reasons."*

- Students also mentioned about their concerns related to what to share or what not to share with their supervisors. By indicating the features of online diary that they used, one student stated that, it was good to write her experience, however it would be very straightforward to share with supervisor. Another student mentioned that instead of writing down what she did, an agenda to write down her questions to ask in the next supervisory meeting, would be more useful. Some examples of student's evaluation of reporting and sharing their experiences are illustrated as follows.

*e.g.*

*"This kind of diary would be very straightforward. I could express my emotions by using icons/levels etc."*

*"Sharing emotions could be too much, they can change and they might be irrelevant after a couple of days."*

#### **4.4.2.2. Conclusions of Study 2**

##### ***Mood Transitions and Stimuli***

- During the interview sessions, discussions related to participants' mood transitions resulted with specific expressions that indicate students' motives for achievement during design projects. As presented in results, three categories revealed as "knowing what to do next", "getting work done in a smooth way" and "being in contact". Students also expressed these motives with their own keywords in the diary. Some example statements from the participants are given below:

*“I want to feel **capable** tomorrow”*

*“I want to feel **guided** tomorrow”*

*“I want to feel **satisfied** tomorrow”*

*“I want to feel **still happy** tomorrow”*

- These keywords and students’ explanations showed that, students associated their design activities with their moods and motives. Explaining the reasons provided details about different stimuli that influence their affective experience, such being happy, excited or frustrated. However, the individual keywords remained quite personal; during the discussions it was observed that many different keywords were used by students to indicate similar emotion, mood and feelings.
- In this sense, in Study 3, reporting the affective experiences with pre-defined visual instruments was evaluated, in order to understand reporting design activities and affective experiences by using the visual instruments.
- Moreover, in diary reports students also reported on the days that they did not work for the project. Although they did not provide information about their design activities with these reports, the reports showed that students’ experiences were not always influenced directly by design activities or outcomes; other practical issues or social dynamics were also mentioned as part of their experiences.

#### ***Motivation for Reporting Experiences***

- By reporting mood transitions, the specific goals and expectations, were revealed by students during the interview sessions. In general, students see the benefit of reporting their experiences as a facilitator for their self-reflection during the design projects. Self-reflection seems an important expectation of students especially during supervisory meetings. In this sense, a self-reporting tool (e.g. online diary) is attractive for students.
- Furthermore, during discussions students mostly mentioned being hesitant for sharing their ideas, thoughts or emotions directly with supervisors. In fact these explanations were based on the affective experiences that were revealed in the diary. The diary reports were very personal, because the content of diary provided freedom to express what and why students feel. However, comparing “what students want to report” with “what students want to share” during discussions was noteworthy for considering the affective experiences in an ESM tool for design education.

#### **4.5. STUDY 3: BOOKLET DIARY**

Study 3 concludes the explorative studies, evaluates the preliminary findings from Study 1 and Study 2, and investigates the visual instruments to report design students’ affective experiences in an ESM tool. Additionally, it aims to observe the responses of students based on their work schedule on a weekly as well as daily basis. In order to allow students to report their experiences whenever they want during the day, the last study took the booklet diary form. During the journey mapping and online diary studies, students described their emotions, mood and feelings in free-forms, by using their own words. In order to enable reporting the positivity and negativity of the affective experiences, two different pre-defined visual scaling instruments were selected and involved in booklet diaries.

Accordingly, first visual instrument was a 10 point Likert scale. Likert Scale is widely used in surveys, or ESM tools, to learn individual's opinions about a specific phenomenon. In the booklet, Likert scale, was used to allow students to rate their satisfaction level (1 being unsatisfied – 10 being satisfied) with their design project, in relation to their design activities.

Second one was a cartoon based pictorial instrument for reporting and expressing moods which was initially developed as part of "PMRI: Development of Pictorial Mood Reporting Instrument" study (Vastenburg et al. 2011). Mood statements include bored, calm, cheerful, excited, irritated, neutral, relaxed, sad, and tense; and they are accompanied by visual representations. Vastenburg (2011) explains that, mood statements were identified based on Russel's model of circumplex affect, which involves two main axes: arousal and pleasantness (Figure 4.11).

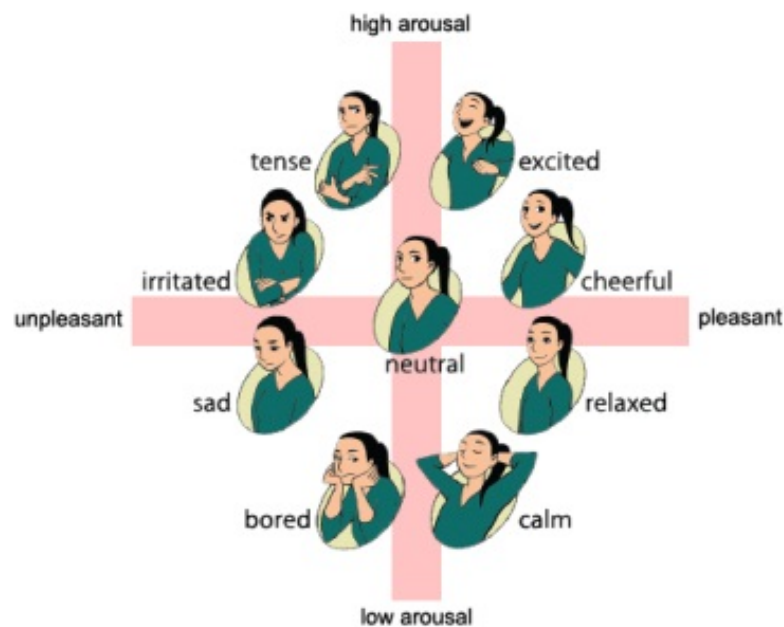


Figure 4.11 Pictorial Mood Reporting Instrument (Adapted from Vastenburg, 2010)

As it was observed in diary study, students indicated the positivity-negativity of their moods, using variety of keywords that express different states such as excited, cheerful, and frustrated. Therefore, all nine characters of the pictorial mood reporting instrument was involved in the booklets in order to measure students' different mood states during design projects and observe their relationship with the self-reports.

#### 4.5.1. BOOKLETS

In order to observe how intense students do reporting, the diaries were designed in a 10x10 cm size booklet form that let participants carry and use it easily. Each page of the booklet consists of two types of measurement (Figure 4.12). First section asks about students' general satisfaction level with their design project. It measures satisfaction/dissatisfaction



level of students about their progress on a 10 point Likert scale followed by the short explanation of reason for their rating.

Second section, questions how students feel about their project at the time and invites to indicate a specific mood (or moods) choosing from a 9 pre-set mood characters. The reason for combining two different measurement tools (i.e. Likert scale and mood measurement) was to observe the way students use different measurement tools in terms of the quality of self-reports that they provide about their experiences.

Time: 28.03.2012

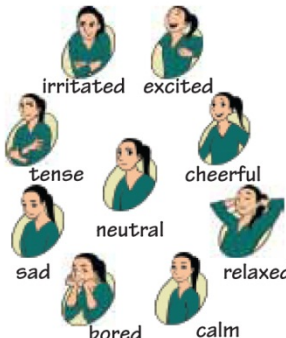
How do you rate your experience with the project in general, on a scale from 1 to 10? (1: unsatisfied 10: satisfied)

1	2	3	4	5	6	7	8	9	10

Can you explain the reason of your rating with a few words?  
Why do you rate it with that number?

.....

How do you feel about your project right now ?  
(Please mark one or more of the mood images below)



irritated   excited

tense   cheerful

neutral

sad   relaxed

bored   calm

Can you explain why you are in this mood right now?

.....

.....

.....

.....

Figure 4.12 Example page from the booklet

#### 4.5.1.1. Participants

Six MSc for Integrated Product Design program students of DUT participated in the study. All participants were selected from students who were working on the same project during 'ID4175 Advanced Embodiment Design' course. This way, it was possible to compare students' self-reporting under similar conditions.

#### 4.5.1.2. Procedure

At the beginning of study, all participants' weekly schedules for their group work and supervisory meetings in relation to Advanced Embodiment Design course was queried. After the sampling days were decided, each student was provided with a booklet. In the booklets, the work days and meeting days were highlighted, and the participants were asked to report

in the booklets twice on those days: at the beginning and at the end of the day. They used the booklets for six days, and then the booklets were collected back.

#### **4.5.2. STUDY 3-ANALYSIS**

All six booklets were transcribed and analyzed separately. Use of the two measurement tools (using Likert scale and mood characters) of the same participant, across six participants and number of responses were reviewed. Fully transcribed versions of the booklets can be found in Appendix D.

##### **4.5.2.1. Results**

###### ***Number of responses***

In total, 54 reports collected during six days of study. All students filled in their booklets almost completely: some students failed to explain reasons of their indications in relation to Likert scale or mood characters. Occasionally, some of the students did not fill in the booklets second time during the same day.

###### ***Using scale and mood characters***

Most of the participants indicated their satisfaction/dissatisfaction level with their projects by using both Likert scale and mood characters including the reasons for their responses. Some participants preferred using mood characters only instead of Likert scale.

Participants were able to indicate different aspects and levels of their experiences. For example, one participant rated his experience as '7', and stated that everybody was present at the meeting; however the participant was irritated by a sub-course assignment. Another participant indicated his experience as '6' over Likert scale and stated that 'there was a lot to do, but chose the mood 'calm' and stated that "there is no need to stress yet, things should work out if we put some effort". Additionally, it is observed that participants were able to link the explanations with the mood characters. This provided more specific explanations about their design activities, instead of only giving a reason such as "good progress".

In general, students used all nine mood states in their reports. Among these mood states, students mostly used tense, excited and neutral mood states. There was no significant difference between the reports associated with different mood characters. However, the reports associated with neutral state, provided more general answers such as "not feeling anything but i think it depends it depends on what happens next"

###### ***Active working days***

In terms of the number of responses received, there was no difference between active working days and passive days (e.g. days that they work for other courses) However, active working days provided more detailed explanations in self-reports. The reasons were that students reported twice a day, and were able to monitor their progress during the day hence provide more details. On passive working days students still provided feedback comparing their mood with the previous day (e.g. "same as yesterday", "a bit more relaxed").

#### **4.5.2.2. Conclusions of Study 3**

##### ***Time of sampling***

Although participants were much busy in the active working days, they filled in their booklets regularly. This way they provided details according to how the day their satisfaction/dissatisfaction level changed accordingly. The results also supported the findings from previous studies. The reports delivered by students on the same day show that, they may sometimes have a problem at the beginning of the day but they may solve it at the end of the day. Therefore, they would be satisfied about the overall performance of the project.

##### ***Quality of self-reports***

Students were not asked to evaluate a specific activity or situation during their design projects. Overall, by asking the general opinions about the project, the explanations did not always indicate design activities or the reasons of their moods.

To conclude, using measurement tools facilitated monitoring the fluctuations in students' experiences. Visual representation of mood characters triggered students to explain more specific characteristics of their experiences; providing answers to what, when, where, who questions. Additionally, scale ratings triggered students to indicate their 'overall' feelings about the project progress.

#### **4.6. CHAPTER DISCUSSION**

*What should the content of tool consist of, considering the design activity, affect, stimuli and motives?*

Students perform variety of design activities which involve different type of cognitive thinking, different materials and tools as well as the results of these activities. This continuity makes it difficult to associate a design activity with a specific feeling. As it was observed in Study 2 and Study 3; the diary reports about affective experience were in relation to previous or future work during design project, rather than indicating the activity that they were reporting about. On the other hand in Study 2, based on reporting mood transitions and discussions on them afterwards, it was observed that, discussions based on mood transitions would be linked to design activities in a more generic manner (e.g. knowing what to do next, be in contact, getting the work done). In this sense, reporting dimensions of student experience would be addressed in three main steps: indicating specific category of activities; mood states and explaining specific activities or stimuli related to the mood states. These three aspects are involved in the content of ESM tool evaluated in main study (Figure 4.13).

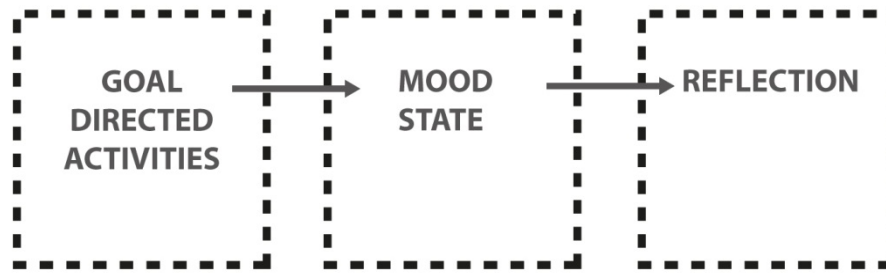


Figure 4.13 Suggested model for content of ESM tool evaluated in main study

*What should be the frequency of reporting in relation to students' work schedule and design activities?*

During explorative studies, number and frequency of notifications was investigated based on students' work schedule and the variety of continuous design activities throughout the day. During Study 2 students provided an overview by filling their online diary at the end of the day. It was observed that students perform several design activities during the day. In the booklet study students were told to fill in their booklets twice a day at their convenience. Although students did not specifically indicate the time of their responses, evaluations that are made two times a day provided rich data about the daily progresses. In this sense in order to monitor the continuity between daily design activities of students, two numbers of notifications are involved tool that is evaluated in main study (Figure 4.14).

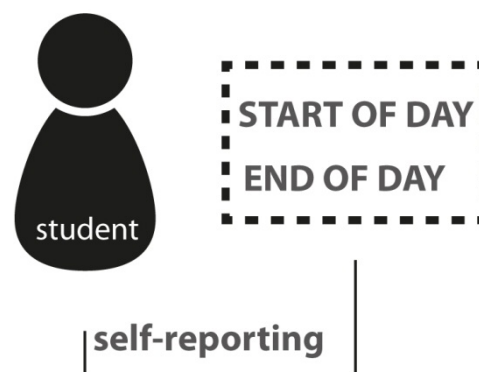


Figure 4.14 Suggested notification times for ESM tool evaluated in main study

*How do students consider the benefit of self-reporting during design projects?*

Students' motivation for reporting was explored based on what benefit they would expect from such kind of self-reporting tool, thus being able to monitor their process and enable their self-reflection. During the discussions in Study 1 and Study 2, the importance of self-reflection during design projects was pointed out by many participants. Students mentioned

that keeping track of how and why they took certain decisions are significant to communicate their work better and have a clear overview about their work.

*What are the privacy concerns of students in terms of sharing their experiences with fellow students and supervisors?*

Although students expressed their interest for monitoring their process in relation to design activities, students' main privacy concerns were related to sharing affective experiences with supervisors. Students specifically mentioned that the affective states might change very quickly during design activities regarding minor problems or non-project related activities. In this sense they agreed that it would be too personal to share these affective states with supervisors.

*How the visual instruments help students to indicate positivity and negativity of their experiences?*

In the online diary, students used a timeline tool to indicate a change in their mood and explained it with self-reports. It helped students to explain their affective experiences with their own keywords. In the booklet study, students used two different types of measurement tools at the same time. Although students used the scale and mood characters evenly, association between design activities and affective experiences was stronger in the explanations that were provided with pictorial mood reporting instrument.

## CHAPTER 5

### STUDY OF EXPERIENCE SAMPLING DURING DESIGN PROJECTS

#### 5.1. INTRODUCTION

This chapter presents the experience sampling study, which brings together the main findings of the three explorative studies in an online survey tool that is evaluated by 19 students for 14 days during their design projects. The intent of the experience sampling study, which named as “Take a Snapshot!”, was to observe participants self-reporting behavior patterns based on the number, frequency and content of responses. In order to gather additional data about the future implications for design of the tool, the interview sessions were conducted after the study.

Accordingly, the chapter firstly explains the methodological approach, set-up and procedure of the study. Then it presents the results followed by the conclusions arrived. The conclusions translate the findings into guidelines for designing an ESM tool that would be used by design students and supervisors. Details of the study follow.

#### 5.2. METHODOLOGICAL APPROACH FOR THE EXPERIENCE SAMPLING STUDY

Based on the main findings from explorative studies, the content of tool was defined and evaluated in a real scenario with an experience sampling study (Figure 5.1). The scenario was created for a specific design course and students were introduced the tool, asked for using it during 2 weeks and evaluate afterwards.

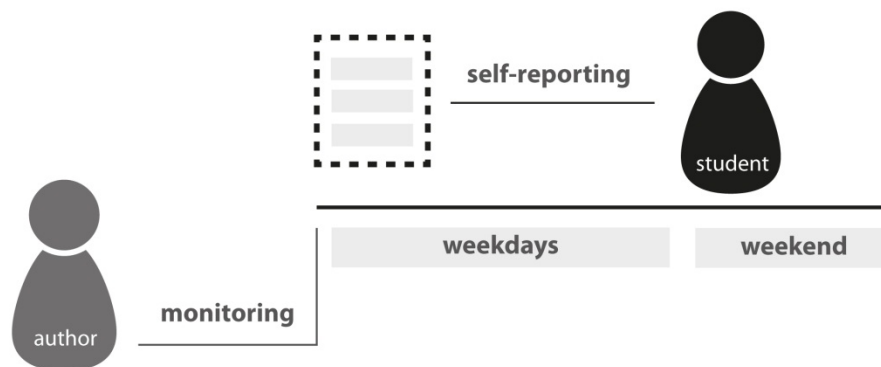


Figure 5.1 Focus of experience sampling study

Evaluation of ESM tool was based on the data obtained from both the responses of participants and the interview sessions. According to results of the survey data, the content of ESM tool was evaluated according to number, frequency and individual explanations that were provided by students in self-reports. Number and frequency of notifications were evaluated based on participants' responses and evaluations during interviews.

During the interview sessions, the results of study were evaluated by focusing on how students experienced the use of tool. Accordingly, design aspects; engagement, privacy and compliance issues were also evaluated based on students' responses. Mainly, students' engagement with the tool was evaluated based on the content of tool in terms of its support to their self-reflection process during design projects. Students' compliance was evaluated based on the frequency and number of reminders, the form of reminders, and the effort they put while responding the reminders. Additionally, students' privacy issues were touched upon in terms of how they want to use the self-reporting tool during the daily life and what personal information they want to (or not want to) share with teammates and supervisors.

### **5.3. SET-UP OF EXPERIENCE SAMPLING STUDY**

#### **5.3.1. EXPERIENCE SAMPLING TOOL**

In order to apply these specifications in an easily accessible tool which allows students to do self-reporting at the time they receive notifications, an internet based tool decided to be used. This way, the tool intended to be use as a platform where student can access via their computers, mobile phones or other mobile devices that have an internet access.

The first main specification defined in the tool was the content. Second specification of the tool was the notifications. The specifications of content and notifications indicated the dimensions of student experiences which were investigated during the explorative studies. The details of content and notifications are explained as follows.

##### **5.3.1.1. Content**

The first part of the content was named as "goal directed activities". Goal directed activities addresses the design activities, in a generic and cognitive level based on three main categories. The second part of the content consists of mood reporting in relation to goal directed activities. Third part of the content is defined as the "reflection" part, which asks students to explain the reason of their mood states. These three main parts are considered as content of tool as illustrated in Figure 5.2.

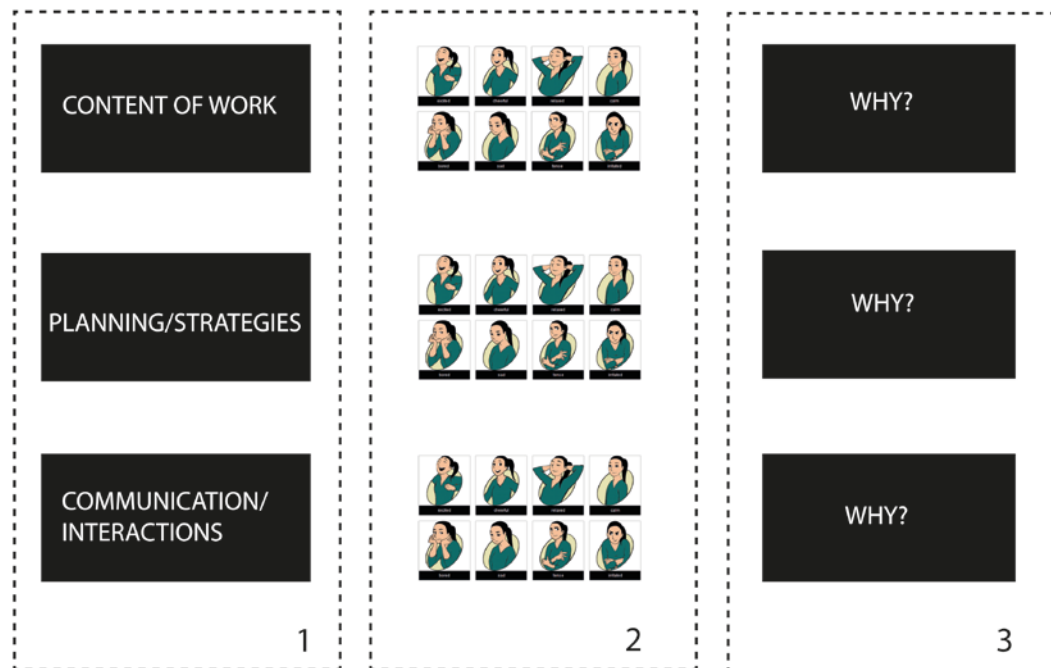


Figure 5.2 Content of experience sampling tool

### ***Content of Work***

This category addresses students' activities in relation their problem solving process; based on how students evaluate their work in terms of the quality, creativity, ideas, and workload (e.g. research, analysis, brainstorming, idea generation, modeling, report writing etc.).

### ***Planning/Strategies***

This category addresses students' decision making process during their activities, based on the strategies and plans that they use in order to progress with their work in relation their schedule (e.g. planning, meetings, discussions, scheduling etc.).

### ***Communication/Interactions***

This category address how the team dynamics, communication with supervisors and other parties that are involved in design projects, based on students' collaboration and engagement activities during design projects.

### ***Mood Reporting***

In order to report on mood states in relation to three main themes, second part involves pictorial mood reporting tool with eight mood characters. As it was mentioned during explorative Study 3, mood states defined with the visual characters helped students to address more specific design activities and reasons while reporting their experience. However, in order to encourage students to provide detailed explanations about their mood, the "neutral" state was not included. Accordingly, the visual characters which represents eight mood states; bored, calm, cheerful, excited, irritated, relaxed, sad and tense were used for mood reporting as illustrated in Figure 5.3.



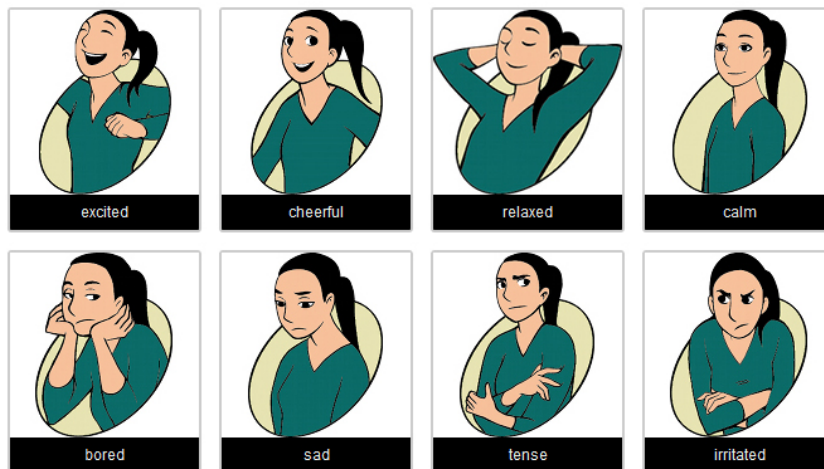


Figure 5.3 Mood characters that are used in experience sampling study

### **Reflection**

Reflection part is involved to collect the individual explanations about three main categories and observe their qualities in relation to mood states. As a part of the content of the tool, it consisted of an additional space in the form of a text box, which allows students to verbally explain the reason of their mood.

#### **5.3.1.2. Notifications**

During the experience sampling study, participants received e-mail reminders that invite them to report their experiences. The reminders were sent twice a day during the weekdays one at the beginning and one at the end of day, based on the general working hours (between 09:00-17:00). During the weekends, students received one reminder per day, only in the beginning of day.

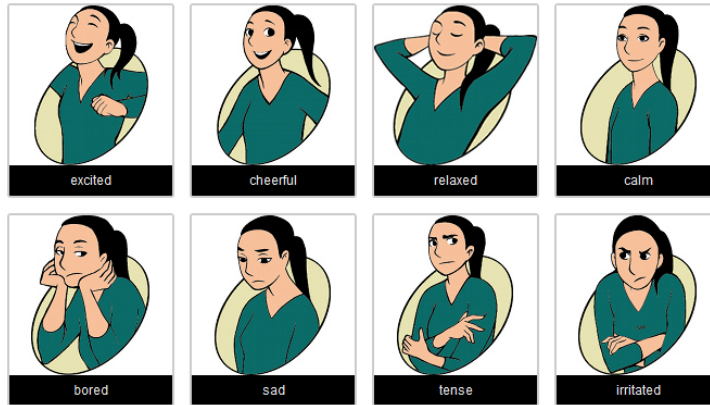
#### **5.3.1.3. Data Collection**

An online survey tool ([www.surveymzmo.com](http://www.surveymzmo.com)) is used for preparing the questions and the links to launch the questions embedded in reminders. The questions were prepared in the form of an individual survey. Three questions were prepared according to the project course that participants followed (i.e. Joint Master Project / JMP Course). These questions involved the additional explanations about what the question indicates (Figure 5.4). Accordingly, the questions were defined as follows.

1. *What is your mood about content of work in your JMP project?*
2. *What is the reason of your mood?*
3. *What is your mood about planning/strategies in your JMP project?*
4. *What is the reason of your mood?*
5. *What is your mood about communication/interactions in your JMP project?*
6. *What is the reason of your mood?*

Content of work refers to design process itself; quality of the work (ideas, research, presentations etc)

1. What is your mood about content of work in your JMP project? NOTE: YOU CAN SELECT MULTIPLE MOOD IN BELOW QUESTIONS \*



2. What is the reason of your mood? \*

Figure 5.4 Individual online surveys that is created for experience sampling study

With the database of online survey tool, the responses from each participant were collected; this way the time and number of responses were observed as illustrated in Figure 5.5.

	#	Status
	19	● Complete – Jun 11, 2012 (19:20)
	18	● Complete – Jun 11, 2012 (11:35)
	17	● Complete – Jun 9, 2012 (13:28)
	16	● Complete – Jun 8, 2012 (14:49)
	15	● Complete – Jun 7, 2012 (21:32)
	14	● Complete – Jun 7, 2012 (12:08)
	13	● Complete – Jun 6, 2012 (09:59)
	12	● Complete – Jun 6, 2012 (09:49)
	11	● Complete – Jun 5, 2012 (11:24)
	10	● Complete – Jun 4, 2012 (21:37)

Delete All Responses Page: 1 Show 10 per page

Figure 5.5 Screenshot from the database of online survey tool

During the experience sampling study, notifications, which remind students to report their experiences, were prepared in the form of e-mail messages. This way, collecting the context data, time and date of responses, was possible via the database of survey tool (Figure 5.6).

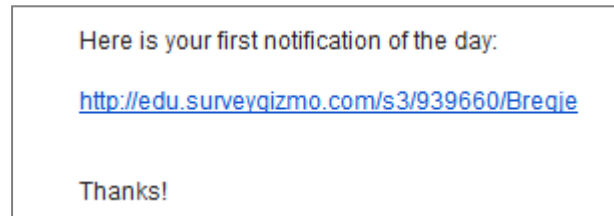


Figure 5.6 Screenshot from an e-mail reminder that students received during experience sampling study

Overall, three main media involved in data collection: The database, where the responses of participants are collected; the surveys that students fill in; and the e-mail reminders that students receive every day. Data collection is illustrated in Figure 5.7.

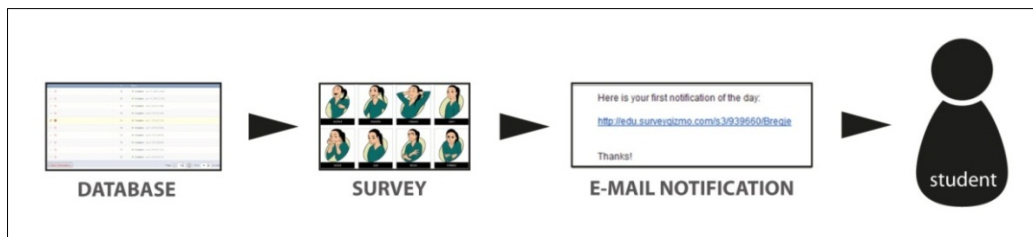


Figure 5.7 Illustration of data collection in experience sampling study

#### 5.3.1.4. Participants

Participants invited for experience sampling study were following the Joint Master Project (JMP) project. JMP is a third semester course in Faculty of Industrial Design Engineering, DUT. Students who attend JMP course varies in relation to which of the three master programs they follow of the Faculty: namely, Strategic Product Design (SPD), Integrated Product Design (IPD) and Design for Interaction (Dfi). At the beginning of JMP course, students from IPD, SPD and Dfi form a group and work on a project throughout the semester usually with companies. Each group of students has their dedicated design studio, where they can work together or individually.

In total, 21 students confirmed the invitation for the study. 2 of the participants quitted the study in the first 2 days, and 1 participant did not respond at all. Therefore, the study continued with 19 students. Between 8 male and 11 female participants, 9 of them were from Dfi, 5 of them were IPD and 5 of them were SPD. The age of students varied from 23 to 28 with a mean of 24. 19 students were members of 6 different project teams in total. The distribution of participants according to the project teams are illustrated in Figure 5.8.

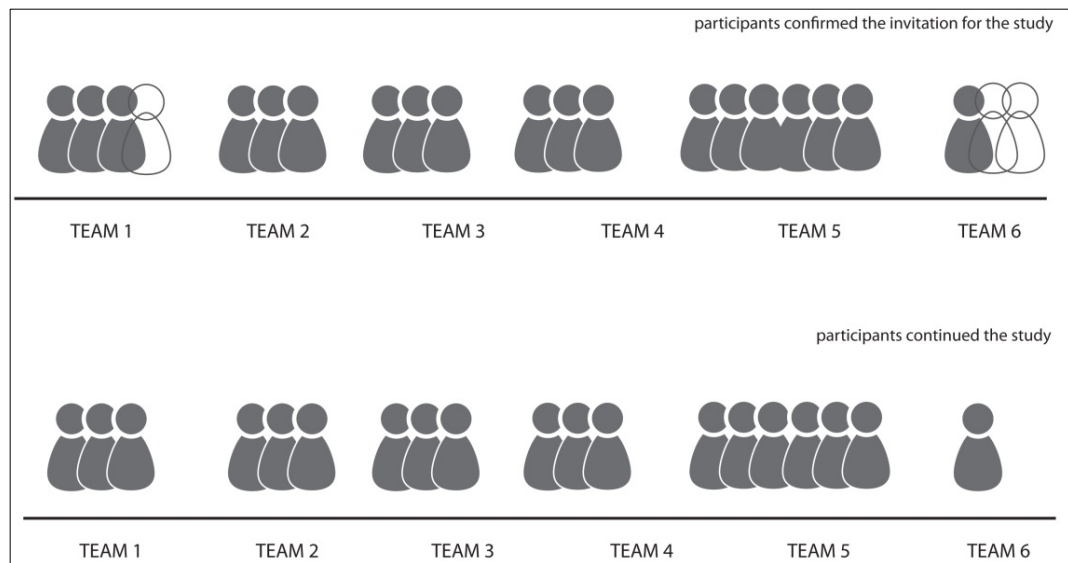


Figure 5.8 Distribution of participants according to project teams

### 5.3.1.5. Procedure

The step-by-step procedure followed to carry out the study is described as follows.

1. First, the aim of the experience sampling study was introduced to students by e-mails and they were invited to participate in the study (see Appendix E). The project teams which were interested in joining the study replied the e-mail back and registered in the mailing list.
2. In total, 19 individual surveys were created for each participant and they received their e-mail reminders separately through their private URLs.
3. Participants were sent two e-mail reminders a day during the week and a single reminder per day during the weekend. Students received a fresh survey with each reminder. They reported on the same content every day.
4. Participants asked to fill in their individual web-based survey and save it to the database. Students were not able to see their previous responses.
7. To evaluate the specifications of the tool, 7 out of 19 students were invited for in-depth evaluation of ESM tool according to their intensity of using the tool during 14 days and their availability.

### 5.4. EXPERIENCE SAMPLING STUDY-ANALYSIS

In this study, different type of data obtained from the survey responses and interviews. The survey responses were analyzed according to the date, time and content of responses.

Results of each participant downloaded in a document which shows all the responses day by day, indicating which day and at what time the student responded the reminder and filled in the survey. Results were then documented in two different Excel documents for analyzing the notifications and content. Both quantitative and qualitative analysis carried out.

Firstly, each response of student was represented on an Excel document, which involves the 2 weeks schedule of study. Additionally, one day of study was represented in three time slots: 06:00-12:00, 12:00-18:00 and 18:00-00:00. After that each response were marked according to the time and day. This way, an overview of weekly and daily pattern for responding the survey was obtained (See Appendix F).

Qualitative analysis was based on the individual explanations provided in the surveys. All explanations were reviewed by the author and highlighted based on types of information they contain. These highlighted information were then reduced in keywords and represented in an Excel document (See Appendix G). While creating the keywords, great attention was paid for not interpreting the individual explanations; the explanations which did not provide enough information to translate into a keyword were also documented and represented with a related name. The keywords were then categorized in six main groups. Six main keyword groups were sorted according to their appearance in reports of 19 students.

The interview sessions were carried out after the preliminary analysis of number and frequency of reports. 7 students were invited after completing the study for the in-depth evaluation of ESM tool. Participants were selected among the students who have different patterns of using the tool and according to their availability.

#### **5.4.1. RESULTS**

The results were obtained according to students' intensity of using the tool; at what times they preferred to do self-reporting during the week, weekend and throughout the day. Secondly, based on the students' reports, the results indicated how students reported on three different categories of goal directed activities, how they used the mood reporting to indicate specific activities, and what kind of characteristics students' reports involved by using the goal directed activities and mood reporting. Details of the results follow.

##### **5.4.1.1. Notifications**

- During two weeks of study, 19 participants received 437 e-mail reminders in total. 361 of 437 reminders were sent during the weekdays and 76 numbers of reminders were sent during the weekends. In general, 232 of 437 reminders were responded by participants (Figure 5.9).

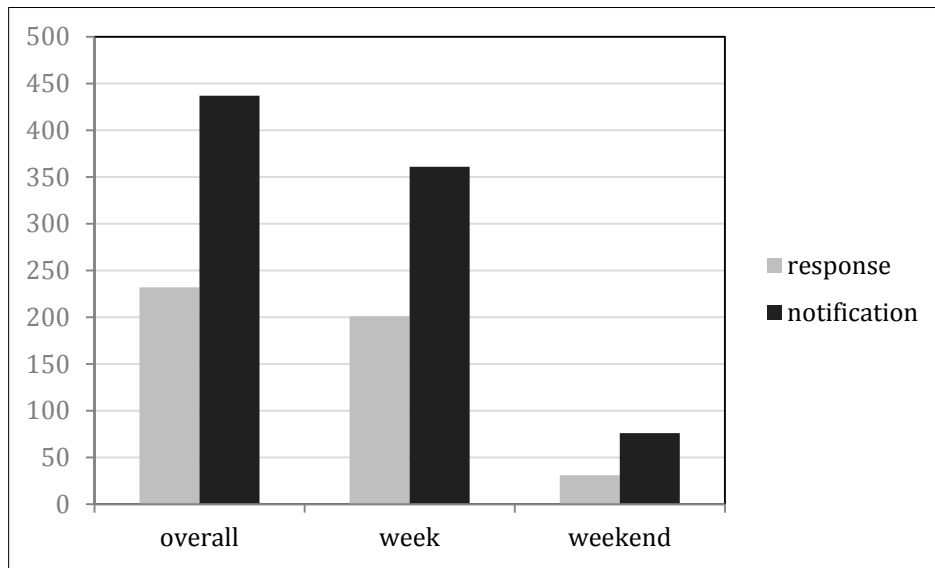


Figure 5.9 Number of responses

- Number of responses was higher during the week compared to weekends. Students responded 201 of 361 notifications during the week whereas they responded 31 of 76 reminders during the weekends.
- Majority of students did not respond the notifications during the weekends. The mean number of response per day remained 1.3 for 2 reminders. During the weekends, it remained 0.4 for 1 reminder per day.
- Each participant got 22 numbers of notifications during 14 days (Figure 5.10). Students responded 15 numbers of reports in average. The highest number of response was 20 numbers of responses by only one student. The minimum number of responses remained 12.

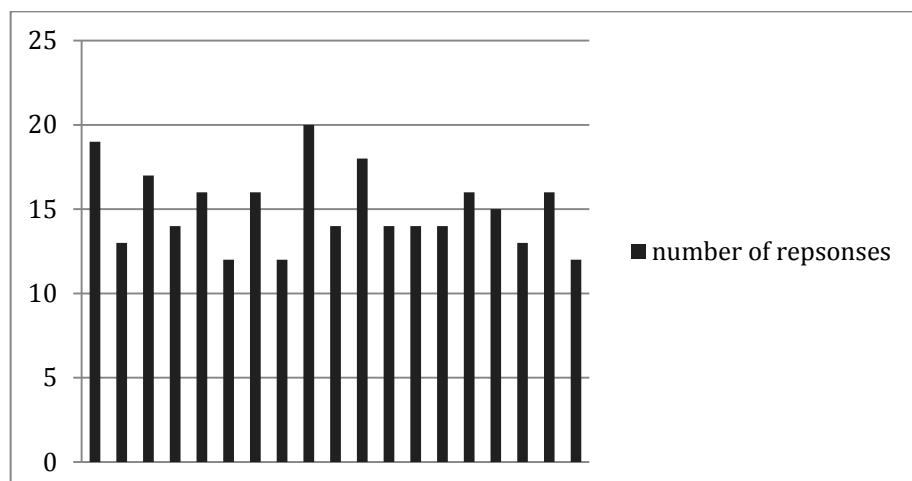


Figure 5.10 Number of responses from each participant

- Throughout the day, number of responses in general dispersed evenly (Figure 5.11). Although students received notifications at the beginning (09:00-09:30) and at the end of the day (17:00-17:30) students' response times during the day was not matching with the notification times. It is also observed that majority of students reported more than two times a day when they did not response the e-mail notifications in the previous day.

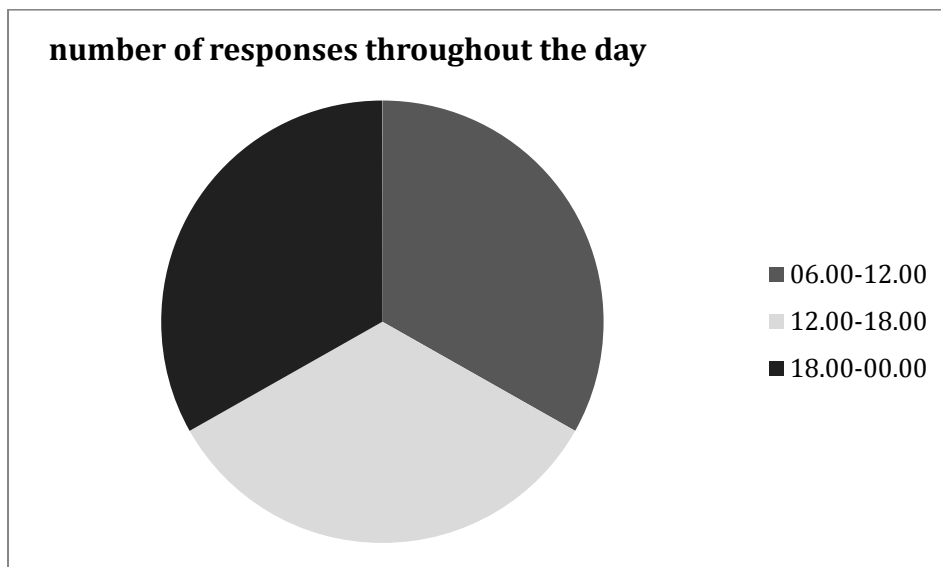


Figure 5.11 Number of responses throughout the day

#### 5.4.1.2. Content

Based on the transcription of reports, six different characteristics defined according to the explanations provided in 'reflection' part. These characteristics were named as *variables*, *design activities*, *outcomes*, *generic expressions*, *passive work*, and *personal*.

Accordingly, *variables* involved the statements which were closely linked to the mood states and indicated the changing situations throughout the time during the project, such as workload, being on track, time pressure, progress, coordination and group dynamics.

*Design activities* consisted of the keywords which indicates performing design activities such as brainstorming, prototyping, to do list, sketching, user test, as well as planning and group work.

In close relation to the *activity*, students also indicated *outcomes* of their design activities. These explanations involved the definitions such as good ideas, prototypes, models, drawings, as well as coach/company feedback and accomplishment.

Students also had *generic expressions* which involved the reasons that are very similar with the title of questions, such as "content of work is good", "planning is going well", "communication is nice.", as well as very short answers such as "it is good".

Students' explanations explicitly indicated the days that they did not work on the project. Therefore another characteristic is defined as passive work. These explanations involved the quotes such as "No JMP today" "I did not work for JMP today."

The last category indicated the *personal* circumstances. In this category students' reports in relation to their mood states involved personal reasons such as waking up late and missing the meeting, or being away for a couple of days.

- All six characteristics were observed in majority of reports individually, in some cases combined with each other. The mostly observed characteristic in students' reports was the variables (Figure 5.12). In some cases, different variables were used together in students' reports, such as the combination of workload and time pressure.

*e.g.*

*Tense/ "A lot to do, in a short amount of time."*

*Tense/ "Lots to do...not a lot of time"*

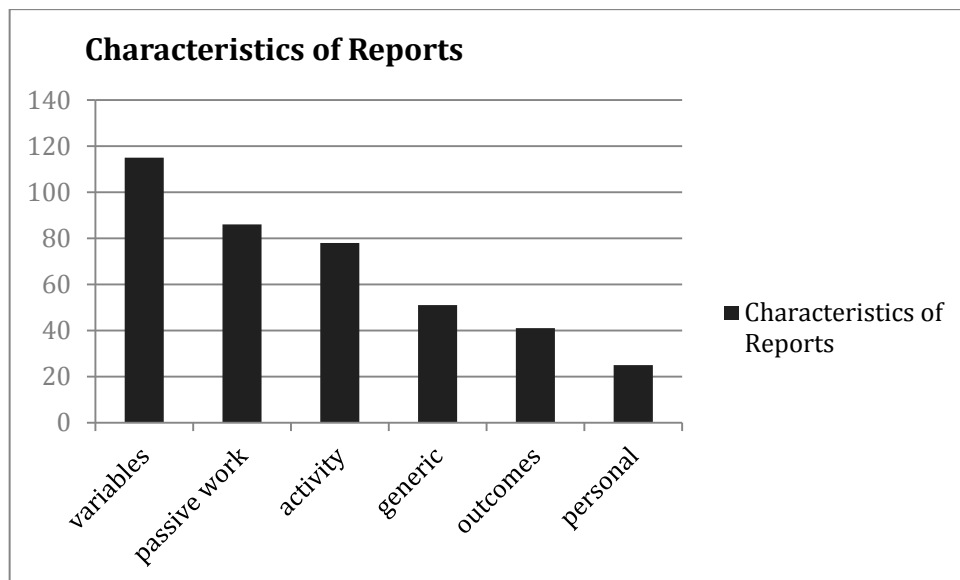


Figure 5.12 Distribution of six main characteristics of reports

- Following the variables, the reports involved the days that students did not work on the JMP project. Students used short statements to indicate the passive work days for each three category. In some cases, students did not use the passive work for each of the three categories. For example when they report "no work" they indicated the e-mail conversations and scheduling for communication/interactions category.
- Reports showed different characteristics within three main categories of goal directed activities (Figure 5.13). Content of work and planning/strategies categories showed similarities with each other compared to communication/interactions in variables group. Especially the workload, accomplishment and progress keywords were observed similarly in both of themes.



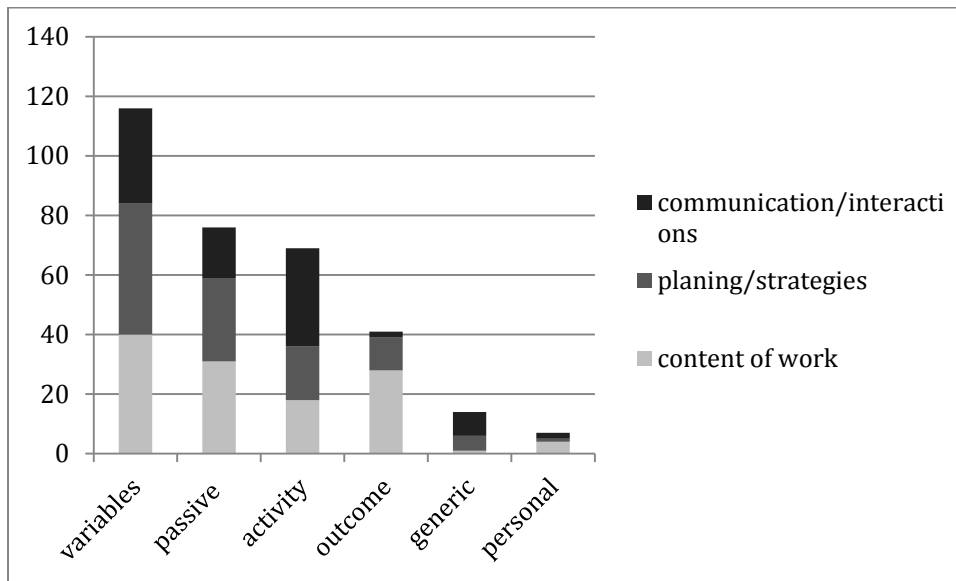


Figure 5.13 Distribution of characteristics according to three main categories

- It was observed that some activities appeared in three categories specifically. In content of work, students mentioned different activities such as user testing and data analysis. Presentation, coach/company meeting, and brainstorming were the other activities mentioned by students. In planning and strategies, students mentioned doing to do list and individual working activities. User testing and presentation were also mentioned. In communication and interactions category, task division was observed in majority of reports. Group discussion, coach meeting, individual work also took place. Brainstorming sessions were also mentioned, by focusing on the activity itself, emphasizing the fun they had during the sessions. In general, activity appeared in communication/interactions more than other two categories; however the statements also indicated variety of different activities such as making appointments, discussing the results and e-mail conversations.
- Outcomes observed mostly in content of work category. Students mostly mentioned the decisions, ideas, models, prototype, and results of analysis and brainstorming sessions. In planning/strategies category, students mentioned the structure of plan, decisions, and coach feedback. In communication/interactions category, the outcomes did not appear significantly. In some cases students mentioned the decisions, or coach feedback.
- In the beginning of the study three main categories for “goal directed activities” were defined in order to address different cognitive aspects of design activities. The statements that were used in activities, outcomes and variables revealed that students reported on different aspect of activities with three main categories. Especially some activities, for example group work, coach meeting or brainstorming appeared in three main categories, with different explanations. For example, in content of work, coach meeting was evaluated based on the quality of feedback. However, when the same activity appeared in planning/strategies, the explanation was related to the schedule problems that students had related to coach meeting.

### ***Mood Statements and Reports***

- The reports showed different characteristics according to the mood states. Variables category had a strong relationship with pleasant and unpleasant mood states. Majority of reports that indicated specific variables also indicated specific mood states. For example the statements such as time pressure, usually indicated unpleasant mood states, such as “tense” or “sad” whereas “on track” indicated pleasant mood states such as “relaxed”, “calm” or “cheerful”. The mood state “calm” observed mostly in generic and passive categories. However, it is also observed in other categories significantly, especially combined with other mood states.
- Although students were obliged to select at least one mood from mood reporting tool, they also used combinations of different moods. In individual explanations of students, it is observed that when students used more than one mood, the reports involved more than one characteristic, or two different conditions related to same activity or outcome. Some examples of using mixed mood states are illustrated below.

*e.g.*

*Content of work/calm-bored “The quality of work is good, yet not innovative enough.”*

*Content of work/relaxed-calm “Today, we are not working on JMP. When I look back at the work done over the past weeks, I feel confident that it is sufficient, yet good enough. It misses “the coolness factor” you want as a designer.”*

*Content of work/calm/tense “Contact with client went well. Still a bit stressed since we do not have much time left to finish the project.”*

- In the online survey students were also provided a free space to fill in when they would like to add an additional comment or idea. Although students did not use this space very often, majority of additional explanations provided by students were related to expression of mood states. Some students stated that they missed other moods such as “tired” or “rushed”. Another student selected the mood “irritated” and “tense” for three main themes but explained that he is still hopeful about the future work. The examples of these explanations are illustrated below.

*e.g.*

*“Actually I miss my mood in this matrix. I feel like running or working as fast as possible, because results are coming in as I work harder. It is a sort of tense, but a happy variant. ‘Rushed’ would be the word. Since this is my natural state when projects run as they should I would have filled it in a lot of times. Now I have to choose between excited, calm and tense, but ‘rushed’ is a combination of the three.”*

*“One emotion that is not on the list is tired. I am really tired or worn out from the project.”*

*“I’m still in a good mood because I believe we will get it right in the end but right now it is not exactly clear how yet”*

### ***Notifications and Reports***

- The characteristics of reports also showed differences according to the time of responses. Students evaluated their experiences based on the time that they responded.

- For example, the reports provided at the end of the day were indicating the activities expected to happen in coming days, such as deadlines, user tests, or prototyping. When they respond in the middle of the day, the activities that they perform at that moment mentioned more. Some examples reports of same participants during the day are illustrated below.

*e.g.*

*Participant X: 2<sup>nd</sup> day, 11:08/tense/content of work/haven't started working yet, lots to do today*

*Participant X: 2<sup>nd</sup> day, 18:29/calm/content of work/ "ok day, make some progress...made planning for more work to be done (additional work hours)"*

*Participant Y: 2<sup>nd</sup> day, 09:36/bored/content of work/ "It is morning, my task is boring, the end is not in sight."*

*Participant Y: 2<sup>nd</sup> day, 18:58/calm/content of work/ "don't know"*

#### **5.4.2. CONCLUSIONS: INTERVIEW SESSIONS**

The interview sessions took approximately 20 minutes with each student. During the interview sessions, students provided explanations about their behavior while using the tool, in terms of the content of the tool and notifications they received. The results are presented by comparing what students did while using the tool and how they explained these behaviors. Additional evaluations are also presented by focusing on students' explanations on the three categories, mood reporting, reflection part, number and frequency of notifications, and additionally, the effort they put while responding to the survey questions.

##### **5.4.2.1. Content**

###### ***Goal Directed Activities***

- The characteristics of reports showed differences in three main categories. Accordingly, students found the three themes clear and sufficient to express different aspects of design activities. During the evaluation, students mentioned that the titles of the three themes covered the significant aspects that influence their experience during design projects.
- According to the results, the activities mentioned in communication/interaction category showed more variety than other categories. Also students used the generic explanations more in the same category. During the evaluation, students mentioned that "communication/interactions" was more specific compared to content of work and planning/strategies. One student mentioned that, communication could be considered as part of group dynamics, which also involves other aspects such as coordination and group energy.
- According to all students participated in interview sessions, goal directed activities guided them to think specific aspect of their design projects, and express their moods in an easy way. In the reports, students also often used the word "same". Students mentioned that answering the same questions everyday was too much repetitive. One student mentioned that although it creates a repetitive feeling during the day, in long term it is useful to have an overview of fluctuations with experience based on same category. Additionally, students mentioned that they did not have relevant explanations for every three category when they responded the survey in

different times. Therefore the characteristics of reports showed difference in three main categories, in relation to different activities performed during the day.

### ***Mood Reporting***

- In general, students found easy and helpful to use mood reporting tool in order to express their mood in relation to three main categories of goal directed activities. However, majority of students mentioned that the mood states did not totally reflect how they actually “feel” about the present situation. This helped them to provide the different characteristics in their explanations.
- In the reports more than one mood state used to indicate different conditions of same activity, outcome or a situation. One student stated that she combined the mood characters and explained her experience better with mixed mood. Another student stated that since the mood characters did not totally reflect her feelings, it made her provide detailed explanations about the present situation. Another student thinks that describing the feeling directly is difficult without any reference, especially while reporting during the day in busy moments. Therefore, she stated that the mood characters provided a good stimulation to reflect on the experiences.

### **5.4.2.2. Notifications**

- Number of responses showed more intensity during the week; students preferred reporting during the days that they actually work on the project. Most of the student mentioned that two times a day reporting was too much. One main reason was being busy during the day and feeling interrupted by two times of reporting.
- On the other hand, e-mail reminders helped them to do self-reporting. One student mentioned that it triggered her to fill in the survey when she saw the e-mail; because it was a quick process. Another student explained that reporting during the day did not interrupt her working flow because it did not take much time.
- Furthermore, some students mentioned that reporting in the beginning of the day was not very useful: it is because either the mood is very similar with the day before or because the activities do not actually start at that moment. On the other hand, receiving reminders two times a day triggered students to response the surveys. Students mentioned that while they are very busy, although it takes little time, they forget responding the survey. Therefore, the e-mail reminders helped them to remember the reporting activity.
- One student mentioned the frequency of reminders by emphasizing the consistency in terms of timing. She stated that, it would be a trigger for her to do reporting at the time when she gets the reminders, if she knows that another reminder is coming afterwards.
- For reporting throughout the week, students mentioned that during the days that they work on the project, it was easier for them to provide explanations and reasons for their mood. Also, all the students stated that they are not willing to report about their design project during the weekends. However, some of the students stated that it also depends on the project: if it is an individual project (e.g. graduation) then it would be useful to report more frequently including weekends.
- E-mail reminders were found easy and useful, since students were able to see them when they work on their computer.
- Overall, students mentioned the benefit of self-reporting during design projects. Some final remarks from students are presented as follows.

*“Good thing about filling in is that, every day I was realizing if I was enjoying the project or not. It changed a lot, it was funny for me to see it, if you don’t think about it you don’t realize or forget”*

*“If I am working three times a week, it could be good to fill in on these days; the days at least I have something to say... it could be like a wrap-up session. But if I am working every day and so much involved in it, I don’t want to do it every day.”*

*“I don’t know if I want to know what others write! It is very nice to do it individually, and then you have time to think and reflect on it...”*

*“Reflection for yourself, trying to improve yourself, and a tool that helps you to do that, it is better...It triggers you to be more sincere, you see the image, and you link it to your feelings, and then you write ‘why’”*

#### **5.4.3 DISCUSSION OF EXPERIENCE SAMPLING STUDY**

During the study, the main findings from explorative studies were evaluated in a realistic scenario. Some findings were validated and some of them were re-evaluated with the interview sessions. The approach for content of tool was to understand if it assists students’ reporting activities. Accordingly, “goal directed activities” indicated different aspects of cognitive thinking during design activities, as defined in the beginning of the study. The category communication/interactions was more specific for students, therefore students’ explanations usually involved a confirmation such as “communication is good”. During the interview sessions, students stated that it was difficult to associate the group dynamics or other social aspects of design activities with this category. “Planning” was also reported as an activity and explanations involved “planning is good”. Therefore, the revised set of goal directed activities defined as “content of work”, “strategies”, “dynamics” and suggested to use with their explanations as in this study.

Mood reporting tool supported students’ reporting activities. However, due to the different design activities and their interconnected relationship, it was difficult for students to express how they actually feel. By using mood states, and combining them, students explained more specific activities, outcomes or other stimulations that makes them feel in a certain way. This way, mood reporting tool guided students to report their affective experiences in an unambiguous way and it supported students to reflect on their design activities.

Based on students’ explanations, the mood states during design projects were linked six main characteristics. These characteristics observed in students’ explanations in relation to their mood states. Whilst carrying out this study, mood reporting tool was also improved and the revised version involves a different appearance (Desmet, 2012). In the main study, students used eight mood characters, however, “neutral” state recovered by the mood “calm” or with students’ generic explanations. Therefore the suggested use of mood reporting tool in an ESM study is to involve 9 mood states including neutral. Furthermore, students confirmed that sharing the mood states with someone else (teammates or supervisors) would not provide a reliable feedback about their actual experiences with the project. However, students also stated that the average mood state on a group level would be valuable in terms of monitoring the mood of team in general. The online surveys were embedded in the notifications and sent to the students by e-mails. In the study, students were asked to response the notifications when they receive it two times a day. Students usually replied the notifications one time a day. However, since the assignment of study was asking students to report two times a day, some of the students responded the notifications

more than two times, especially after the days they did not respond at all. Accordingly, in some of these reports, student explained their experiences of the previous day. During the interview sessions, one student explained that, she supposed the notifications she responded will appear in the database according to the time the notifications were actually sent. However, in online survey database, students' responses were recorded according to the time they responded the notifications.

In some cases, the responses that provided at the beginning of the day involved explanations such as "nothing really happened yet". Regarding to these explanations, students mentioned that reporting at the end of the day helped them to think about the overview of the day, evaluate the activities and report their mood states accordingly. On the other hand, students also provided detailed information about specific design activities or personal reasons when they respond the notification at the time the activities are performed.

About the number of notifications, although students stated that two times of reporting was too much for one day, they mentioned that notifications triggered them to report their experiences regularly. In this sense, two numbers of notifications was not interruptive or disturbing for students.

In this study, students did self-reporting by means of online survey. Great attention was paid to prepare short and clear questions. Students evaluated the effort they put based on the online survey, which was a specific case for this study. Reporting with the survey did not take more than 3 minutes, however it was also related to length of explanations in the reflection part.

Additionally, the notifications that were sent during the weekends, received less response than the weekday notifications. The characteristics of responses during the weekdays remained in the passive category, which indicates that students do not think about the project, or not working on the project. During the interviews, students confirmed that they do not prefer reporting about their design projects during the weekends.

Lastly, during the study, the students were able to send an e-mail to the author and ask questions about the study. Author also sent e-mails when necessary, to remove misunderstandings. This helped to keep in contact with participants and make interventions in the first days of the study.

## **5.5. DESIGNING AN ESM TOOL FOR DESIGN EDUCATION**

To sum up, the main conclusions related to content and notifications are linked to design requirements for the ESM tool and presented as guidelines, which aim to show directions to designers for design implications based on content and notifications involved in the ESM tool. During this study main focus was to explore design requirements for an ESM tool which assists students to do self-reporting about their experiences regularly, and allows supervisors/students to monitor these experiences during the time period in between two subsequent supervisory meetings.

The main findings about the content and notifications of ESM tool indicated that these features can indeed improve the design of tool when they are correctly applied to enhance the engagement, compliance, privacy and adjustability aspects.

### 5.5.1. GUIDELINES: ASSISTING STUDENTS' SELF-REPORTING ACTIVITY

- Design students' experience is driven by design activities which are interconnected to each other and performed continuously throughout design projects. Therefore as illustrated in Figure 5.14, **the pre-set categories functions as a starting point to report about student experiences in relation to design project based on different cognitive aspects.** The content of tool covers three main cognitive levels of design activities and it is called "goal directed activities" that are content of work, strategies and dynamics.



Figure 5.14 Suggestions for content of an ESM tool for design education

- Content of tool should also guide students to report their affective experiences in an unambiguous way. **Pictorial mood reporting tool supports the reporting activity and facilitates students' reflection on their experiences, rather than just communicating their feelings and expressing the student experience** (Figure 5.15).



Figure 5.15 Mood reporting as part of content of tool

- Students are able to do self-reflection by using personal explanations, with the help of mood reporting and three main categories. As the self-reflection is facilitated, students' engagement with ESM tool is enhanced accordingly. However, mood reporting and self-reflection activities should remain personal in ESM tool in order to consider the privacy issues. **In this sense, privacy for mood reporting and self-reflection enables the engagement** (Figure 5.16).

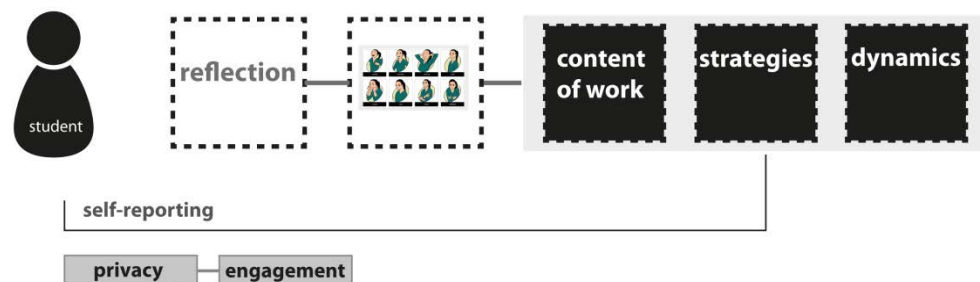


Figure 5.16 Relationship between privacy and engagement criteria in an ESM tool for design education

- The obligatory reports are suggested to apply one time a day. However, considering the busy work schedules of students, more than one reminder with a fixed frequency could be involved into the tool, in order to trigger students to response.

#### 5.5.2. GUIDELINES: MONITORING THE STUDENT EXPERIENCE

- **There are many (past and future) factors that influence students' evaluation of his/her own experience at the time when they do self-reporting.** In this sense more specific characteristics of student experience could be involved in self-reporting activities. While student do self/reporting, students could indicate relevant characteristics according to what they do and how they feel about their design activities. By selecting these characteristics, students indicate different aspects of their experience when they do self-reporting: (Figure 5.17)



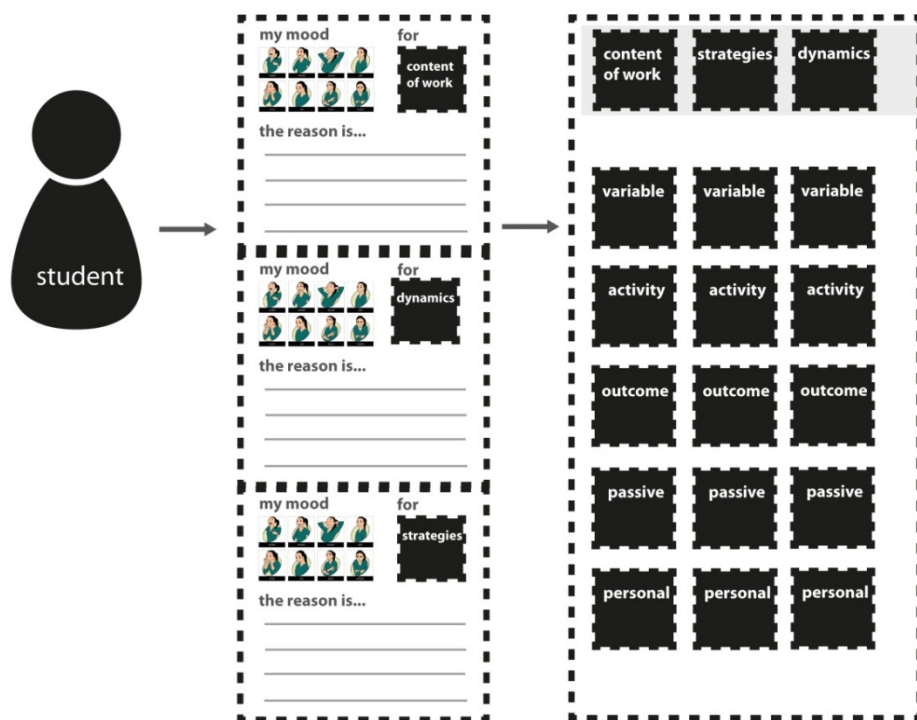


Figure 5.17 Student's reporting activity based on five main characteristics

- Variables have usually direct link with pleasant and unpleasant mood states of students and indicate how students perceive the time pressure, workload or progress (e.g. efficient, slow, progress)
- Activity and outcome related reports indicates students' evaluation of their performance during design activities while designing (e.g. dividing tasks ,individual working, making discussions) and the results of their activities (e.g. decisions, ideas, accomplishment).
- Passive indicates students' work schedule and the moments they are mentally distant to the project (e.g. weekends, off days).
- Personal circumstances also influence students' performance with design activities and therefore their mood state.
- There are also moments that students do not have a specific feeling about their work, or the moments that they don't want to share their experience. Generic is not involved as a separate characteristic, because it does not provide an ambiguous feedback about their experience. However, by allowing students freedom for not choosing a specific characteristic, their willingness for reporting can be investigated.
- Accordingly, the five main characteristics of students' self-report (i.e. variables, activity, and outcome, passive, personal) indicate what student experience or what they prefer for reporting about his/her experience. **This would be a good starting point for designing a feedback system for monitoring students' process in between two supervisory meetings; based on number and time of reports for each characteristic appears in each three categories of goal directed activities (Figure 5.18).** This way, in long term it would be possible to keep track of

experiences according to the specific dates or time periods or number of reports that student provide.

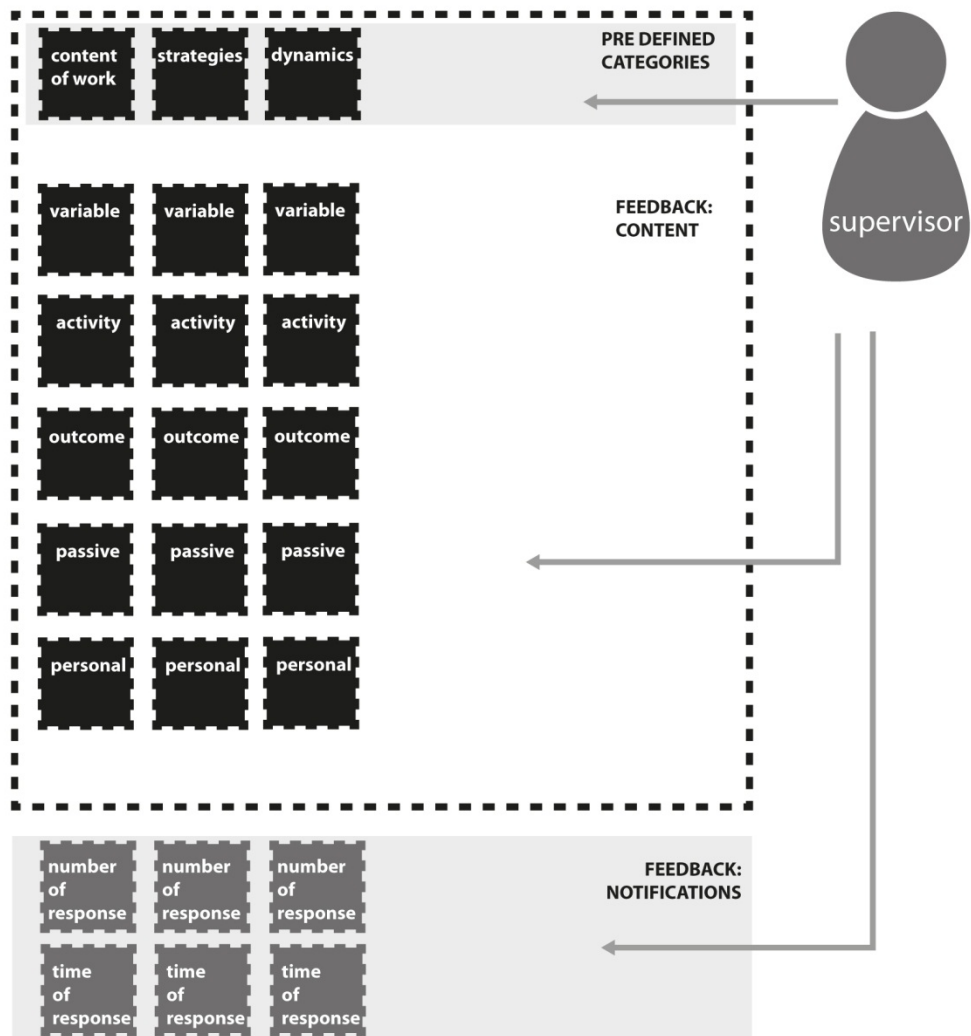
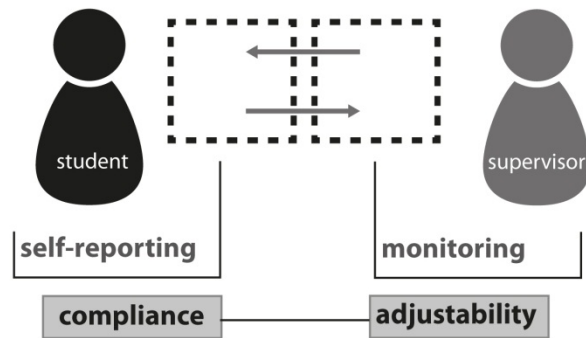


Figure 5.18 Illustration supervisor's activity of monitoring student experience

- Secondly, **notifications can also assist different type of self-reports at different times of day and week.** Daily reports provide an overview when they are provided at the end of the day, which are useful to address outcomes or more general evaluations related to variables. The same understanding can be applied in the weekly reports, students can be asked to evaluate the week with an extra weekly reminder.
- Students' compliance while self-reporting also has a strong relationship with the content of tool. **Regarding to the dynamic nature of continuous activities during the day, answering the same type of questions might end up with boredom in long term** (Figure 5.19). In this sense, the adjustability of content according to the

course schedule, or supervisors' and students' preference would address to enhance the compliance of students in long-term reporting.

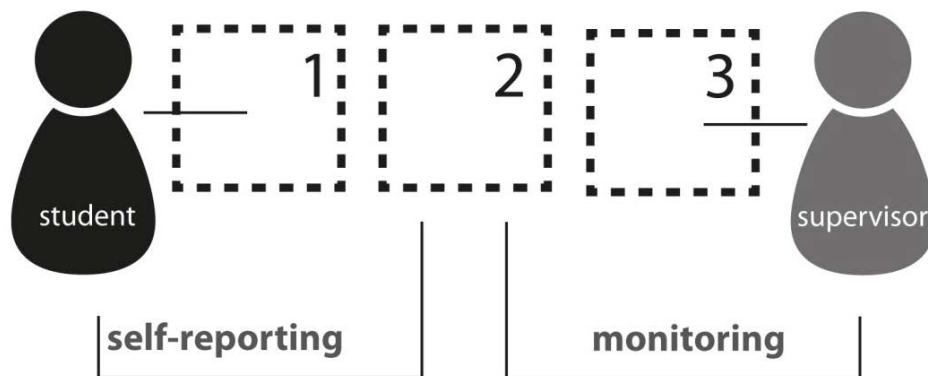


*Figure 5.19 Relationship between compliance and adjustability in ESM tool for design education*

### 5.5.3. GUIDELINES: DATA COLLECTION

Additionally, while designing an ESM tool, data collection should address the needs of target users: supervisors and students. According to the presented guidelines related to reporting and monitoring, the data collection can be defined in three steps as illustrated in Figure 5.20:

1. A medium that provides notifications for students to indicate their reporting activity.
2. A medium that records students' reports and represent them continuously.
3. A medium that allows supervisor to adjust the notifications or the content of reporting according to the purpose of monitoring.



*Figure 5.20 Illustration of Data Collection with ESM tool*

To conclude, with the presented content and guidelines for reporting and monitoring student experiences, further implications for prototyping can be explored, according to students' and supervisors' preferences in specific design project courses.

# CHAPTER 6

## CONCLUSIONS

### 6.1. INTRODUCTION

This study presented an iterative approach for exploring the design specifications of an experience sampling tool to be used by students and supervisors during design projects. Two main features, reporting and monitoring were investigated by focusing on students' self-reporting throughout the explorative studies and in main study.

In order to evaluate the methodology followed and provide guidance for future implications, revisiting the research questions, discussing the limitations and recommendations would be necessary.

Accordingly, this chapter presents the answers for research questions and discussions on how the terms reporting and monitoring have been explored and evaluated by iterative studies. After that, the limitations of study are discussed with a special focus on the technical features of experience sampling tool and their application throughout the main study. Lastly, chapter ends with the recommendations for future design implications and explorations. The recommendations are offered for prospective designers, researchers and supervisors who are interested in design or application of an experience sampling tool for design education.

### 6.2. REFLECTION ON RESEACH QUESTIONS

**Q.1.** What are the dimensions of reporting the student experience during design projects?

At the beginning of the study, the student experience was defined as "how students think, or feel about their activities." "The student experience" is a broad term which involves many inputs in relation to educational psychology, design education as well as cognitive aspects in design. Throughout the literature review, the student experience was firstly explored based on the relationship between design students' learning experience and design activities. Reporting the student experience was elaborated on the different aspects of design activities; cognitive/meta-cognitive thinking skills, as well as visual and social aspects of designing activity. Literature review revealed that, in order to address students' "stuck moments" during projects, four main dimensions of the student experience should be involved in students' self-reporting. These dimensions are defined as design activities, motives, stimuli and affect. Explorative studies investigated using these dimensions in a regular self-reporting activity, which is supposed to be monitored in long term. During the explorative studies three main steps of reporting the student experience defined. First step was the cognitive level that indicates similar type of design activities in terms of cognitive thinking; such as in process and about process activities. Based on students' reports, social and communication skills (e.g. having good time with group mates, bounding activities) also involved in this level. Second step was mood reporting followed by reporting about the reasons of mood states. In experience sampling study, students' reports elaborated into more specific characteristics. According to the conclusions, students report their experience considering variable situations (e.g. time pressure, progress, being on track, workload), design activities, outcomes of design activities, work schedule as well as personal

circumstances. These dimensions are used to define the guidelines for the content of ESM tool that would be developed for design education.

**Q.1.1.** To what extent are the capabilities of available tools satisfactory/unsatisfactory in terms of reporting students' experiences?

Existing tools that support reporting the design activities and the student experience were limited, in terms of reporting affective experiences of design students in relation to their design activities. Among the tools which addressed dimensions of student experience, online blogs seemed to provide a platform for students that they can express their experiences by using different media or verbal comments. By using the blogs, students are encouraged to do regular self-reporting in a personalized way by using different media and verbal explanations. However students' self-reporting are not guided and the content of blogs are not pre-defined, therefore the blogs do not always reveal what student experience, yet they are used for documenting what students do in between supervisory meetings. In cultural probe workbook, students are guided through several questions to reflect on their feelings and stuck moments. Although the content of workbook guides students to report and reflect on their experiences, it is used only for students and it is not intended to provide a feedback for supervisors to understand the student experience. Also, the paper-based workbook is only used when student feel in a stuck moment, therefore it does not encourage to do regular self-reporting. Overall, as it was expected, these tools seemed insufficient for assisting students to report regularly and guiding students to explicitly focus on the relationship between specific activities and their affective experiences.

**Q.1.2.** How can design students be assisted to report their experiences regularly throughout design projects?

Throughout the literature review, design activities were discussed according to the cognitive aspects, as well as visual and social aspect that are involved students' design process. In explorative studies, students were guided to associate the relationship between design activities and affective experiences. Explorative studies revealed that different design activities are consecutively related to each other considering design students' learning experiences. Because of this consecutive relationship, it is usually difficult for students to indicate a feeling about the design activity, at the time they do self-reporting. Based on these insights, the experience sampling study involved an online tool which sends notifications to students in order to remind them do self-reporting during the day. Also, the online tool assisted students to report their experiences in three steps. Students' self-reporting activity addressed firstly three main categories (content of work, planning & strategies, and communication & interactions), secondly reporting a mood state in relation to these categories and finally explaining the reason of the mood state for each of the categories one by one. In this sense, three main steps: goal directed activities, mood reporting and reflection which were involved into the content of ESM tool enhanced design students' self-reporting activities. During experience sampling study, this framework was supported by pre-set categories that represent the cognitive level of design activities and a pictorial mood reporting tool. In order to assist students to report regularly, the reminders were also used as part of the study.

Experience sampling study revealed that guiding students to firstly think about the generic level, then expressing the affective experience and afterwards indicating other characteristics provides a clear overview about the affective experiences and their connection with design activities. Reporting the mood states in relation to design activities plays an important role for assisting students to reflect on their experiences.

The eight mood characters that were used in the experience sampling study (i.e. irritated, tense, sad, bored, calm, relaxed, cheerful, excited) assisted students to indicate their feelings, especially pleasantness, unpleasantness and the combination of these two states in relation their experiences. Additionally, being able to select and combine the mood which best suits their feelings, helped students to explain the reasons and reveal more specific aspects of design activities which influence their experience (e.g. outcome, group mates, models, work schedule etc.)

**Q.2. How can design students' reporting activities about their experiences be monitored throughout design projects?**

Explorative studies revealed that, involving the affective experiences into the monitoring activity might cause two reliability issues:

First, due to students' privacy issues, the feelings remain quite personal for students to share with teammates and supervisors. Secondly, due to the nature of experience sampling method, and students' continuous learning experiences, the moment students report about their mood states is influenced by past and future factors, therefore it is difficult to "sample" the affective experiences, in relation to design activities. Therefore, in experience sampling study students' explanations about their mood states also analyzed in order to observe the common patterns in students self-reports which might be used as a feedback for monitoring the student experience. Accordingly experience sampling study revealed six main characteristics of students' reports that are linked with affective experiences (i.e. variables, activity, outcome, generic, passive, personal). By focusing on these characteristics, it was possible to monitor what students experience in relation to three main categories based on time and number of responses. Therefore, in an ESM tool for design education, by focusing on the relationship between number and characteristics of reports; students' activities, the outcomes, students' work schedules, variable factors that influence their mood states (e.g. workload, progress), personal circumstances, as well as their willingness for participating the self-reporting activity as part of design project activities would be monitored.

**Q.2.1. What are the main features of existing experience sampling tools that aims monitoring individuals' daily life experiences?**

Since the focus of the study was to assist students' self-reporting activities, the main features of existing experience sampling tools were investigated based on the strategies for data collection and optimizing self-reports in experience sampling studies. Accordingly, two main features of the experience sampling tool aimed to be identified before conducting the experience sampling study, which were the content and notifications. The content of experience sampling tools mainly indicates type of questions that participants answer. Notifications indicate the time and frequency of self-reports based on the characteristics of experience. Also, three main criteria for designing an ESM tool defined which were the engagement, compliance and privacy. All three criteria address the main specifications of experience sampling methodology, and aims to encourage individuals to do self-reporting regularly during a long period of time and support researchers to monitor and manage the data provided by participants. These factors were further investigated in order to define implications for an ESM tool which is specifically designed for students and supervisors in an educational context.

### **6.3. LIMITATIONS OF STUDY**

As mentioned in the beginning, the studies carried out by only focusing on students' self-reporting behaviors. Supervisor's perspective were not involved in the studies, therefore, although there are conclusive results for defining the content of tool and notifications, the guidelines for monitoring remained as suggestions, since they were not evaluated by supervisors.

Defining specific characteristics of reports in experience sampling study also had some limitations. The experience sampling study conducted during two weeks at end of the semester with a specific design project course. Although the background of participants and the projects involved in the study varied, the duration of study and the characteristics of the project course caused limitations in students' self-reports in terms of diversity of activities, outcomes or variables mentioned. Therefore, students' self-reporting of their experiences throughout the whole project instead of a specific time period would illustrate the dimensions of student experiences in a more detailed way.

Conducting an online study also conveyed practical difficulties. As it was presented in main study, the data collection strategy of ESM tool consisted of a database, the survey and the e-mail reminder which contains the URL link to the online survey. During the study, the notifications were sent manually by the author. Moreover, the experience sampling study conducted during two weeks, and participants' behaviors were also influenced by other factors such as not understanding the assignment, or not being able to connect the internet. These caused the decrease in number of responses.

### **6.4. FURTHER RESEARCH**

The presented features of content and notifications have potentials to be implemented in mobile applications, and prototypes can be developed by iterative processes. In this sense, presented guidelines set-up an initial direction for possible use of content and notifications while designing and prototyping the experience sampling tools. This way, designers can also explore different use of technologies focusing on the feedback mechanisms, or the type and form of notifications. Based on the experiences, results and observations; other research questions also aroused during the studies. In this manner, improving design of tool combined with technical aspects conveys different directions for designers:

#### **6.4.1. Recommendations for Designers**

##### ***Existing Technologies***

By monitoring the mood reports of the students who are in the same team, in some cases it was possible to get an overview of when students are concerned about the workload, their progress, or when they are excited about the outcome. Also during the discussions, students were interested in learning the general mood state of their team. Therefore, mood reporting can be explored by involving the average mood state in social media applications where students instantly follow the changes of mood state in their studio or team. Moreover evaluating how students' reporting behavior changes when they keep track of average mood of studio could be also investigated.

##### ***Software Development***

Throughout the explorative studies, design students' reporting behaviors, such as the time and the days they work on the project, the number of responses they provided, revealed



insights about how the feedback mechanisms can be studied in further design explorations. However, an important aspect of an ESM tool would be to investigate the software that addresses how students' reports are collected, what kind of database is used to collect the reports, and how the notifications are adjusted by supervisors.

### ***User Experience***

Reflection part, where students are able to think about their mood state and explain "why" question, enhances students' engagement with the tool. It allows students to involve personal explanations about the mood states and goal directed activities. This part is suggested as a private space for students. However in the main study, the reflection part consisted of a free form space, which only allows students to make verbal explanations. In the future implications "personalization" could be also explored as a concept while designing the reflection space, and this way, the engagement with the tool could be evaluated.

### ***Case Studies***

Throughout this study, six different master level design project courses in Industrial Design Engineering Faculty of DUT were studied. It was observed that, each design course has different characteristics that influence the student experience. Therefore, case studies are recommended in order to adjust the experience sampling tool for each specific context of different design projects. These case studies would be especially useful to explore the data collection methods, associated with the characteristics offered in the content of tool. For example, in a design course that involves modeling and prototyping, students could use different media to "report" on their experience, such as picture taking, sound recording etc.

#### **6.4.2. Recommendations for Researchers**

There also some general remarks for researchers who are interested in using experience sampling method within/for design studies.

In an experience sampling study which intends exploring the features of an ESM tool, there could be also compliance, engagement or practical issues caused by the data collection strategy. Therefore the tools that are chosen to carry out an experience sampling study plays important role in terms of its influence on participants' self-reporting behavior.

The value of explorative studies before applying experience sampling study is undeniable, in terms of finding a specific direction for investigating further. However another characteristic of explorative studies is that, they provide many different insights and research questions which might be very interesting, but not directly related to the aim of current study. Researchers should be careful about defining clear research questions for explorative studies and answering them directly.

If there is an iterative process, it is also very important to define the "action" and "reflection" stages during the research studies in order to keep the simplicity and clarity of research study.

Experience sampling is a valuable technique in order to evaluate long term interactions of users with specific products or applications. However, if Wizard of Oz techniques are used (e.g. sending notifications, updating information) the time and effort that is devoted for the study should be also considered precisely. To conclude, all the insights presented in this study aims to shade light on developing new design concepts that facilitates reporting and monitoring student experiences in the context of design education.

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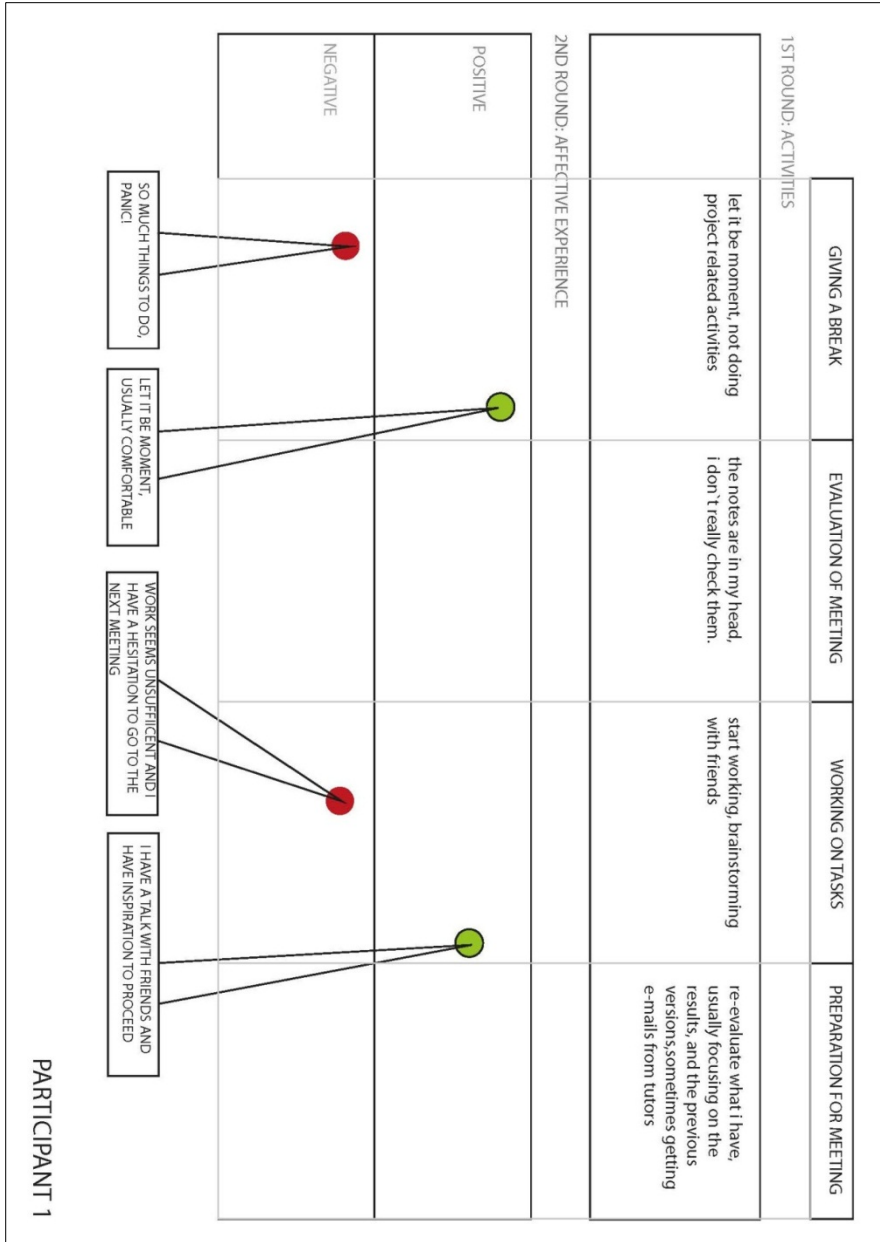
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## APPENDIX A

### RESULTS OF JOURNEY MAPPING SESSION FROM 1<sup>ST</sup> AND 2<sup>ND</sup> ROUND



*Figure A1. Journey Mapping Diagram: Participant 1*

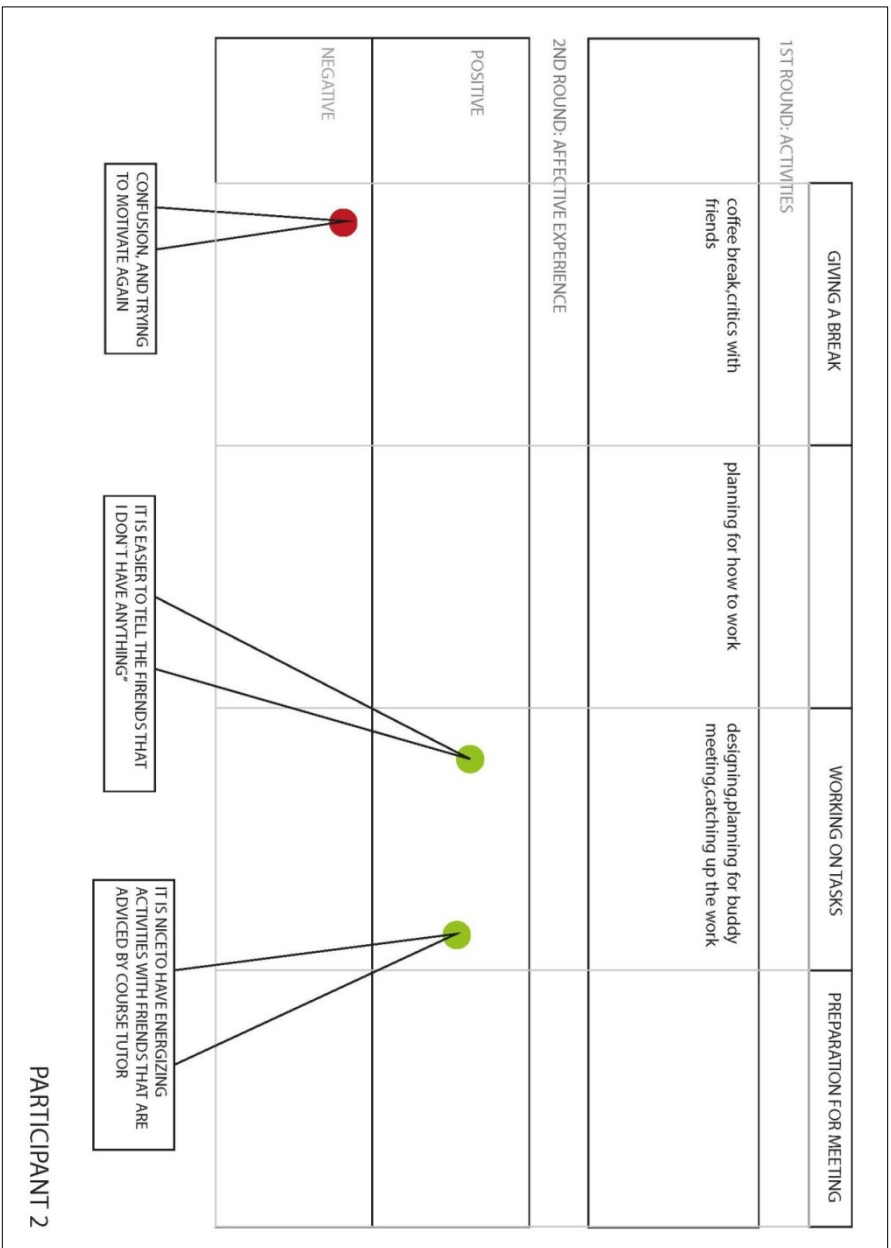


Figure A2. Journey Mapping Diagram: Participant 2

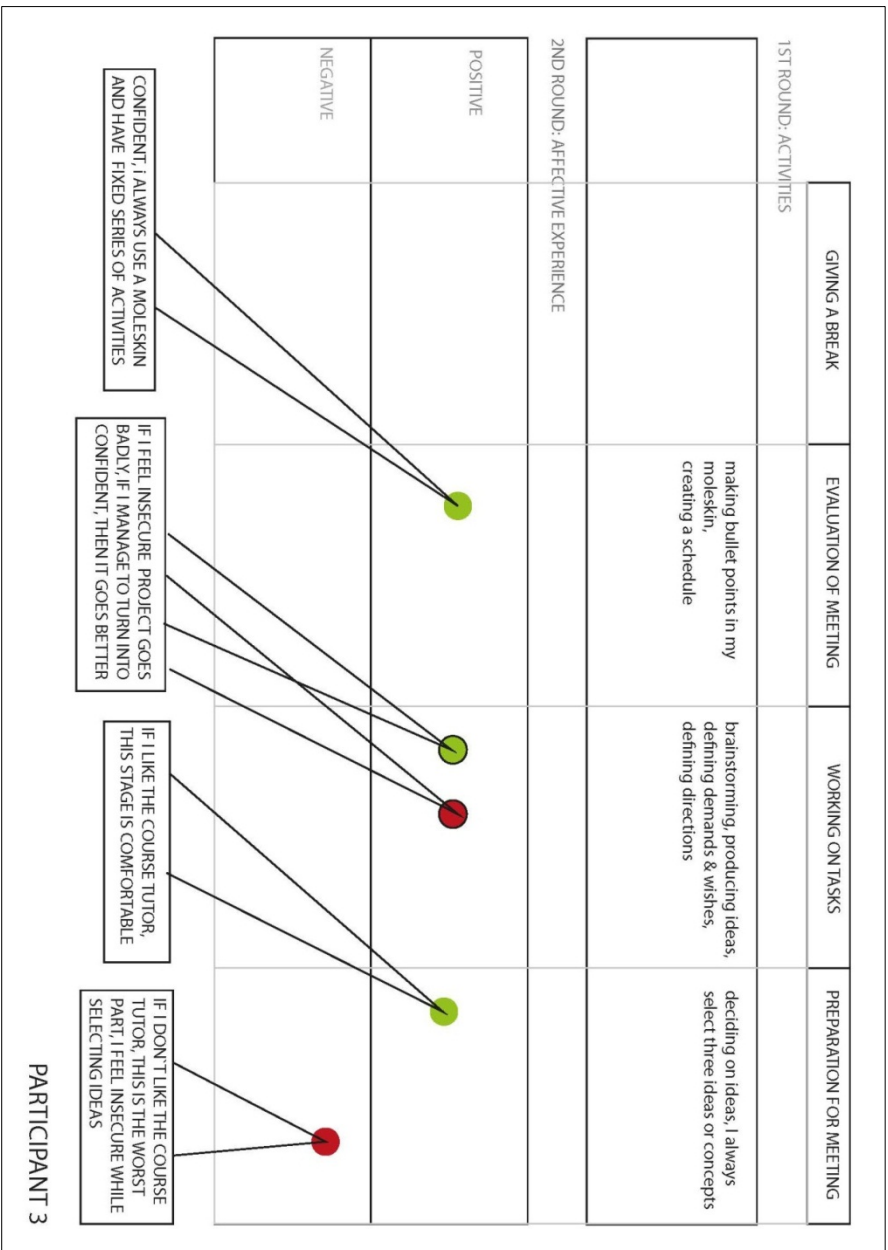


Figure A3. Journey Mapping Diagram: Participant 3

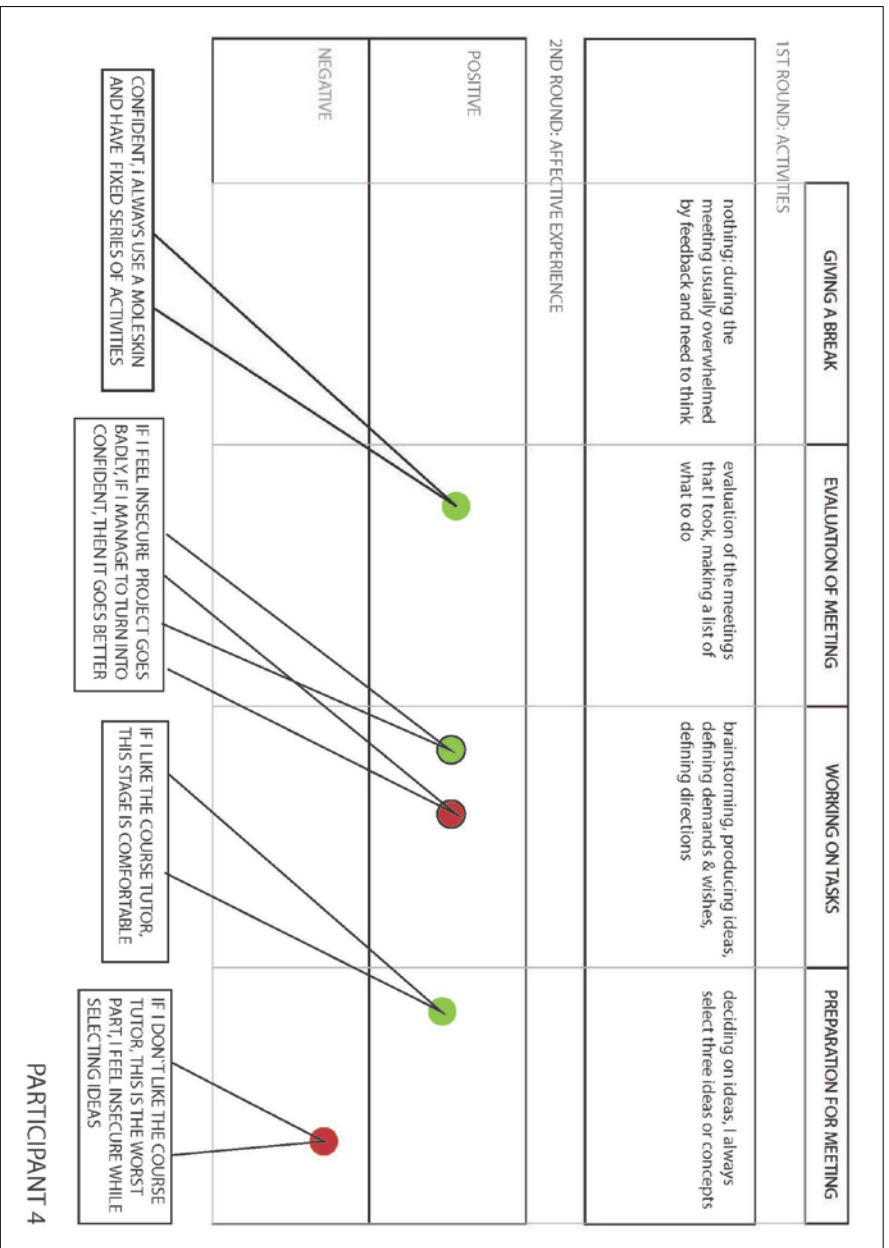


Figure A4. Journey Mapping Diagram: Participant 4



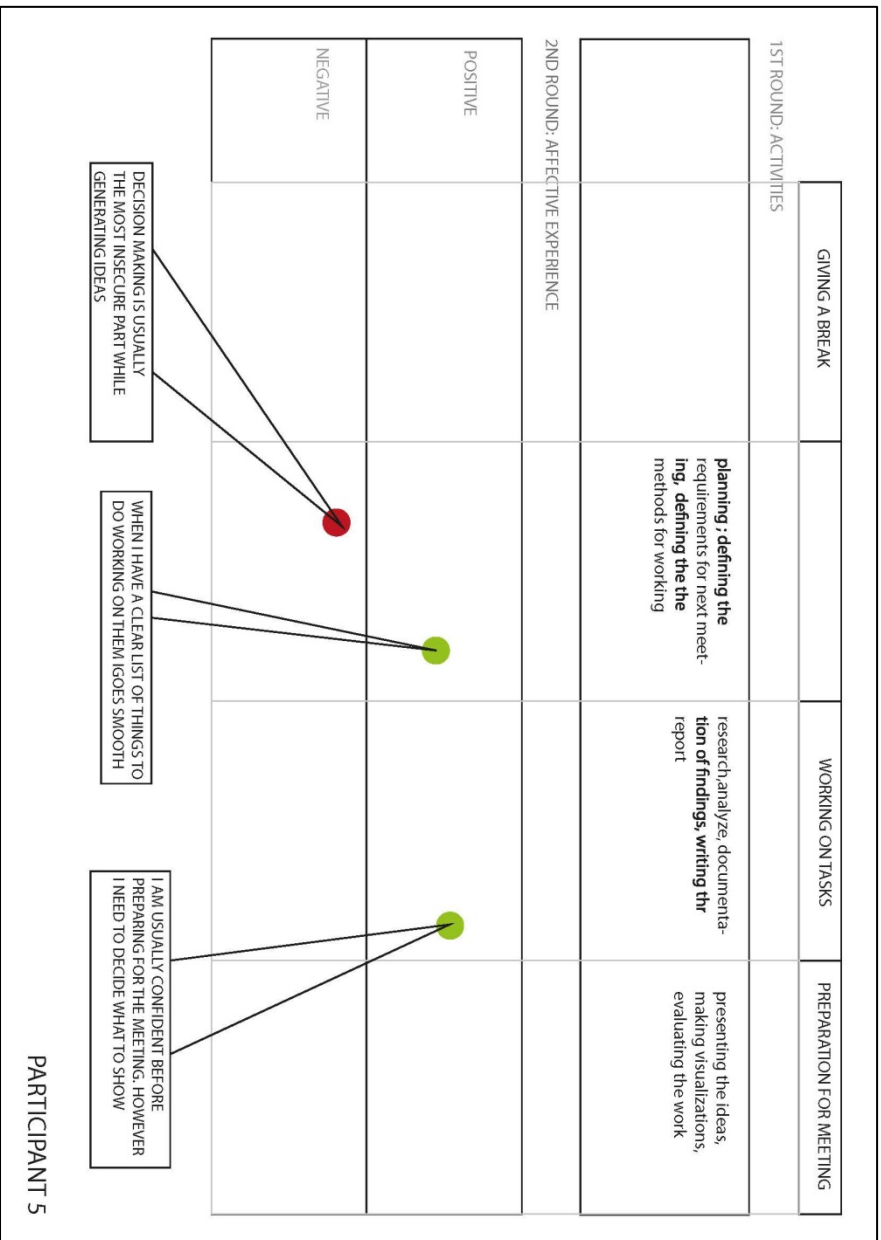
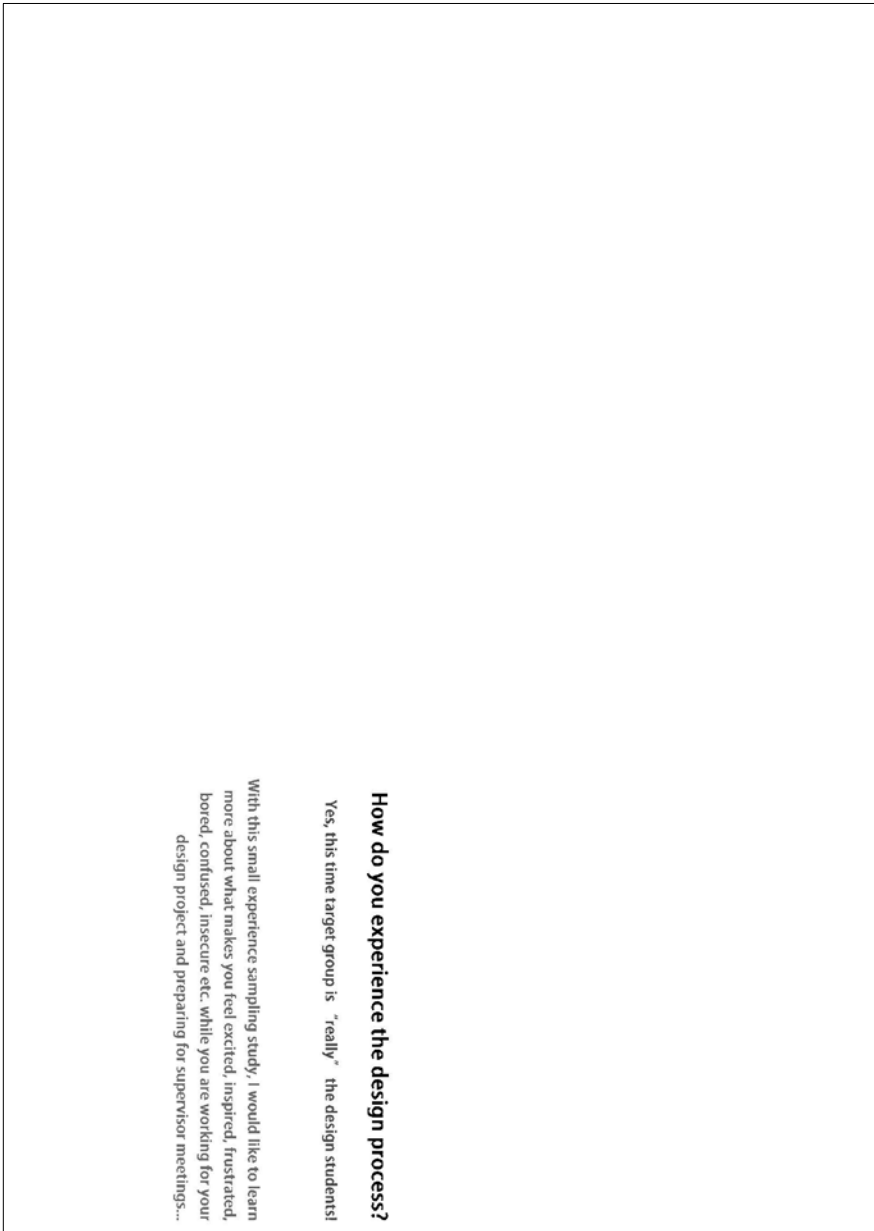


Figure A5. Journey Mapping Diagram: Participant 5

## APPENDIX B

### DIARY USED IN STUDY 2



*Figure B1. Online Diary: Page 1*

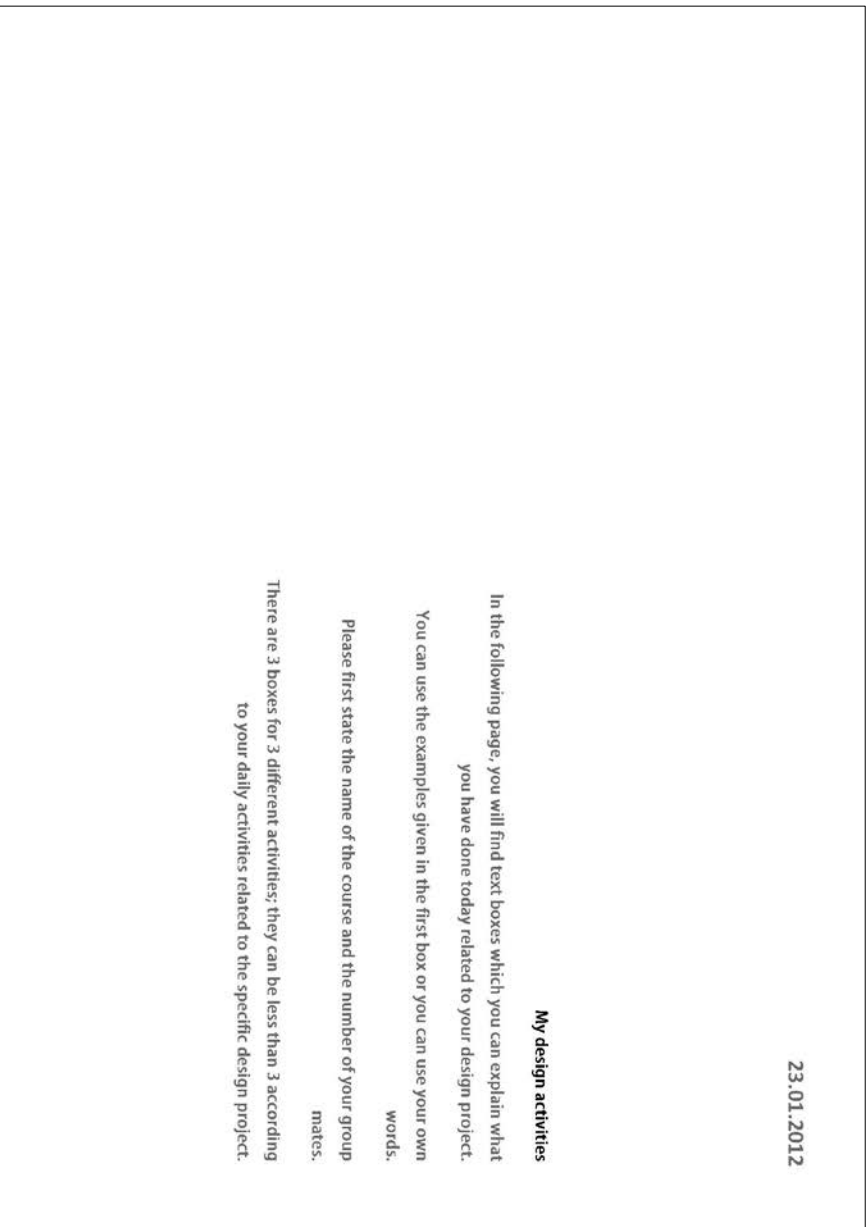
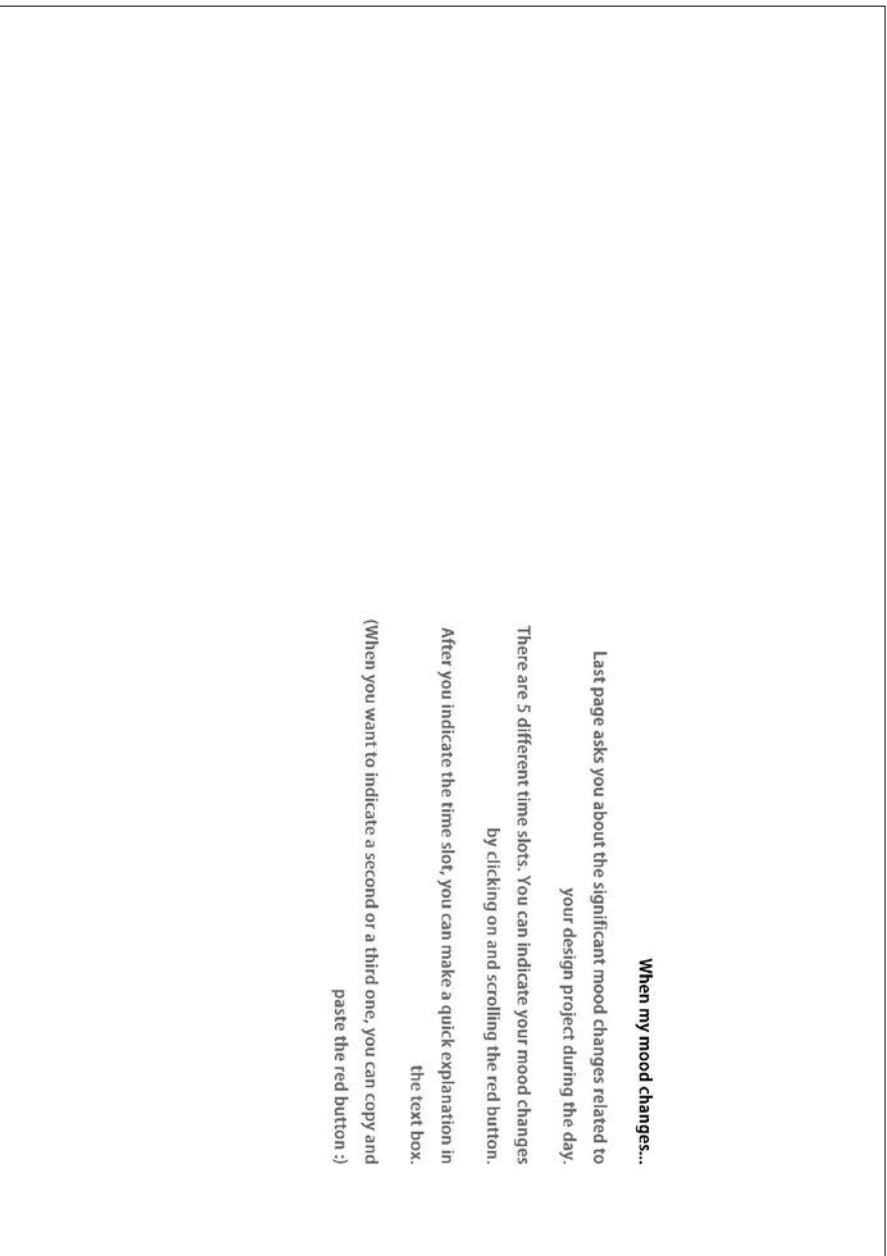


Figure B2. Online Diary: Page 2

WE TALKED...	IT WAS...	BECAUSE...
<p><b>Subjects</b></p> <p>Good points, improvements, related projects, planning, technical details, general process etc</p>	<p><b>Feelings</b></p> <p>Boring, annoying, exciting, inspiring, motivating, confusing etc</p>	<p><b>Reason</b></p> <p>Why did you feel like that and why</p>
<p>We talked... It was... Because...</p>		
<p>We talked... It was... Because...</p>		
<p>We talked... It was... Because...</p>		

Figure B3. Online Diary: Page 3



*Figure B4. Online Diary: Page 4*

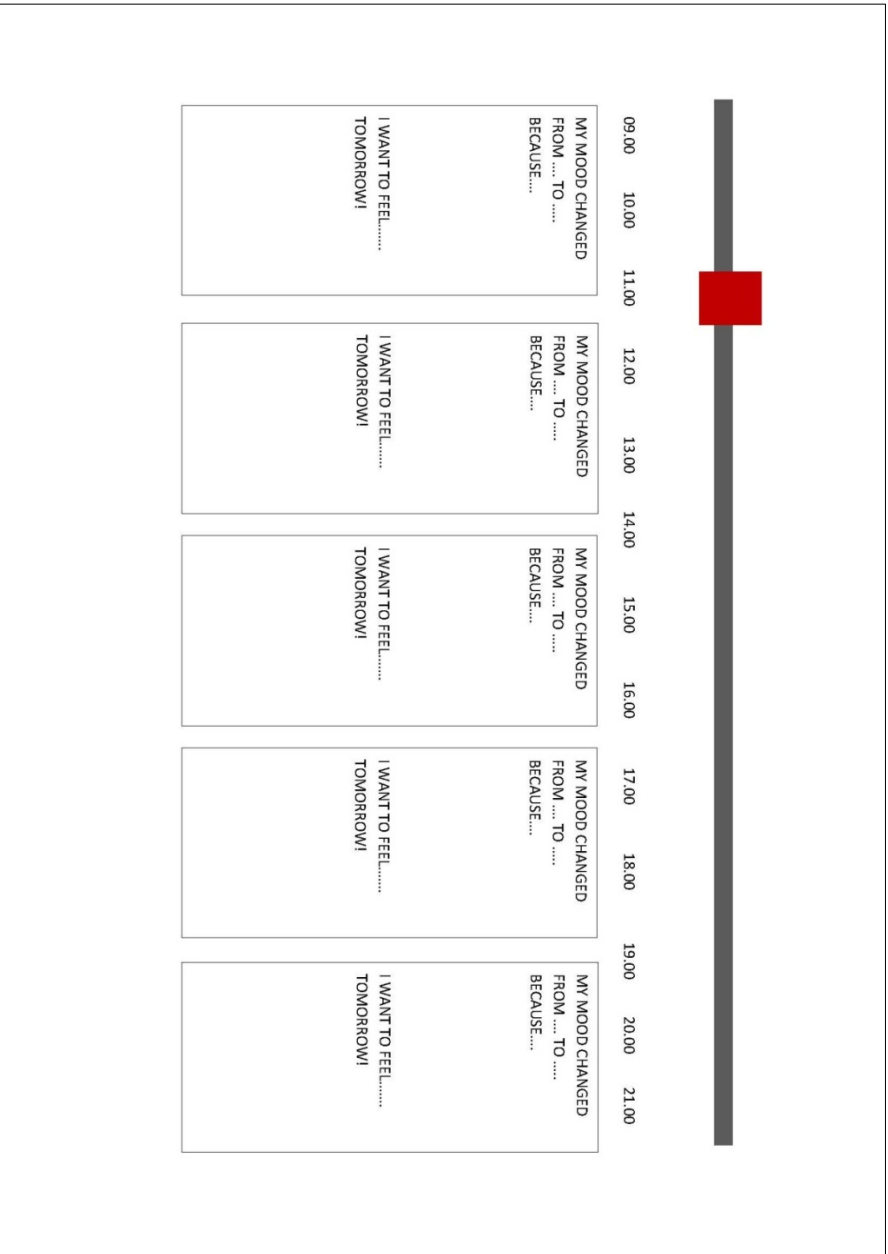


Figure B5. Online Diary: Page 5

## APPENDIX C

### ACTIVITIES, FEELINGS, REASONS MENTIONED IN DIARY AND INTERVIEW IN STUDY 2

*Table C1. Online Diary Results: Page 1*

Activities	Mood	Reason
Networking	Clear minded	Seeing the whole image of the project
Proposal writing	Confusion	Question marks, don't know what the mentor thinks about that
Working on a task	Bored	Too much work
Nothing related to current project. Student assistant for another course.	Relaxed	Nice to have a break and not think about the project at all.
Meeting with group	Satisfied	Feel like they have a direction and not that lost
Brainstorming	Satisfied	Assignment was interesting and they had exciting ideas.
Writing report with the groupmate	Tired and satisfied	A lot of work but managed to finish before the break
Group meeting, to-do list	Confident	Feel more experienced than the others in the group
User testing	Happy	Many participants were found and group mates were helpful
Company visit	Cheerful	Nice inspiring discussions with the group mates on the way.
Brainstorming	Happy	Crazy out of box ideas
Work division-Planning of the day	Satisfied	Everything went off smoothly and decided to be the second programmer
Brainstorming	Satisfied	No problems in the end
Attended programming elective	Excited	Opportunity to learn it finally and it is not an individual responsibility like previous years.
Started first assignment, didn't work out, changed the plan but not working really efficiently	A bit frustrated	Because no time left to test the result and being in a rush reduces the quality of work...
Nothing; we rescheduled our meeting to a lunch break	Annoyed	I don't like spending my lunch breaks studying...
Nothing; I thought we planned to do the testing this lunch-break but it happened to be tomorrow	Relieved	Because I could spend my lunch break freely

*Table C2. Online Diary Results: Page 2*

Activities (Meetings)	Mood	Reason
Talking about the work which is done before meeting	Motivated	Finding out more details about the topic
Not a supervisor meeting but attending a lecture	It was Inspiring-Motivating	Got Useful information about the assignment
Discussion on the work which was done during the week	Satisfied	As supervisors told they were ahead of the other groups and task execution was well managed by the group.
We talked about the progress of the project (what we have done so far, what we found, what's the next step) and discussed about the questions we had	Confused	the tutors did not give much help in guiding us.



Table C3. Online Diary Results: Page 3

From	To	Reason	Expectation tomorrow
Unclearness	Clearness	Mentor showed a clear way	Feel advanced on her topic
Anxious	Satisfied		
Tired Bored Satisfied	Bored Satisfied Bored	Long day and exciting ideas during the brainstorm	Satisfied /Excited
Satisfied	Excited		
Excited/Enthusiastic	Stressed	Because we underestimated the work	Relaxed
stressed/pessimistic	Opportunistic	We just had a one hour lecture, had more time to work	Satisfied
Opportunistic	Stressed	Because the test didn't work out, I was too tired and hungry to continue	Relieved
Neutral	Annoyed	Because the work is going to take another lunch break	Relieved/Satisfied
A little bit stressed	Relieved	we did not work today on the project	not-stressed tomorrow because it is not necessary to stress for this (small) assignment!
Neutral	Happy	Because dull testing seemed to be fun after all!	Still happy!
Calm	Anxious	I have to finish a lot of work in a very limited time.	Free
Excited	Challenged	I like the project offered by the company.	In control
Excited	Frustrated	I felt that the group lacked focus and I think the other two members usually have	Capable

Table C4. Interview Transcript: Page 1

Participant 1	
00:30	Brainstorming was good so I was satisfied.
00:56	I was satisfied because we managed to finish the report.
1:20	The meeting was satisfying. It was related to the work we did. Also the group was really organized. Supervisor was also happy with this organized work.
2:01	I was excited during brainstorm; if the discussion is nice, ideas are getting better and the other way around as well.
3:10	When you have a meeting with your supervisor, knowing that he is guiding you in the right direction. Then it is a satisfying meeting.
4:23	Satisfying meeting depends on supervisor a lot. They sometimes do not consider there are people from different backgrounds.
6:00	It is important for me to hear not only the work is wrong but also the reasons why it is wrong.
7:10	It is not important if supervisor have a negative attitude, as long as he gives suggestions how to make it right.
9:50	Once I spoke to my supervisor about my problem. But it didn't work.

Participant 2	
00:45	It was about time planning, couldn't arrange with other people. I wanted to get it organized and relieve!
2:00	We started UXAD, ITD, VCD and we are still discussing "how to start". We are not really working yet.
4:05	If I know when to do, what to do then I am also relaxed. But if it is a mess, then it is stressful.
5:18	To see some progress is important for me. If everybody works, the progress is faster!
6:00	When it is an individual project, you are a bit more insecure but you are busy with your own process. You just work a bit longer at night and that is it.
6:25	There are many concerns not content related in the group.
7:30	It is good to have guidance, to know borders. Because sometimes you have too many directions.
8:40	You cannot interrupt/ add something when other group member talks. Then you miss some questions you want to ask.
10:00	Sometimes I need informal communications. If you feel a hierarchy then you don't dare to say everything.
12:10	I need support as well. If I do something good, then I want to hear it. For example I needed to hear it in EI.

Participant 3	
1:00	While discussing the project with tutor, I noticed that the outcome of the project could be a tangible product. I got more motivated and feel more advanced.
2:50	I wrote my proposal and sent it to supervisor, she didn't reply back, would be nice to get a reply instantly, I could save my time.
4:00	If I feel in control, I am on the way to feel advanced, giving right answers, asking right questions.
5:05	Negative attitudes make me de-motivated. Because then I start panicking about my process, next steps etc.
6:30	I hesitate to share all my thoughts with my supervisor.
8:07	I think it would be nice to have an agenda to guide the meeting. Sometimes you are overwhelmed by discussions and criticism. You forgot what to ask.

Table C5. Interview Transcript: Page 2

9:12	This agenda could be shared with supervisor so they know what you want to ask/share. But I don't know if I want to share emotions.
10:04	If you have an emotion it might change during or until the meeting, I think it is too much information and it can make distracted from context.
11:10	Supervisor is going to give you the grade in the end. If you give so much emotions and it can be less objective.

	Participant 4
00:50	The project was going very well, and the teammates did a very good job in brainstorming. We produced a lot of interesting ideas and then we were able to translate them into design concepts.
1:45	Some communication issues in the team made me upset, although it was not related to the work itself, it influenced the atmosphere, and I got a little bit upset.
3:16	There was a close deadline, I was very stressful, but teamwork helped me to relieve a bit, at least more secure. This is usually the case in group projects.
5:00	I felt that the group lacked focus...also two of team members could not make it to the meeting. It made me a bit frustrated.
5:50	The planning part started to be over-whelmed, I realized that there is a little time and still a lot of work to finish!
7:05	We had a meeting with the company, it was a very good meeting, I started feeling "challenged" which was good, it made me more motivated for the rest of the work, because I liked the topic.
8:50	Supervisor meeting went well as well, since we were all very motivated, although it was the second meeting, I think we managed to create a good impression..
10:40	In general, I like to be guided by supervisors, in a way that it gives sort of an "alert" to me, if I am missing a point, or not able to communicate well. In fact, they are the ones who grade you, but for me more important thing is to have a satisfying result, therefore I don't mind receiving negative feedback related my work.

## APPENDIX D

### EXPLANATIONS ASSOCIATED WITH TWO VISUAL INSTRUMENTS FOR REPORTING AFFECTIVE EXPERIENCES IN BOOKLET DIARY STUDY

*Table D1. Booklet Diary Results: Page 2*

Participant 1/number of response: 9						
day1	day2	day3	day4	day5	day6	
7/efficient good mood	6/lectures only/no project	8/nice project still	6/a lot to do	6/same as yesterday	7/we're moving again	
excited/we are making good progress	bored/lectures were not good	irritated/ not everybody did their job	neutral/other subcourses require my attention	neutral/sub courses as well	excited/time for a new day of work	
8/good cooperation relaxed/the tasks are divided evenly		8/good progress bored/ a long day at office time for weekend!			8/we're getting somewhere excited/it was a very productive day	
Participant 2/number of responses: 9						
day 1	day 2	day 3	day 4	day 5	day 6	
6/could have done more work	5/lecture feels useless	7/fertile day for project	7/content about the weekend	6/other courses ask a lot of work	7/multi tasking on open days	
tense/behind in work while others are up to date	irritated/whole day of lectures and could do more useful work	cheerful/feel like getting things done	neutral/fresh start of the week taking it easy to start up	tense/ conflicting agendas of projects	cheerful/fun teaching and at the same time getting some work done	
7/got a bit more done		8/good day			6/still a lot to do	
calm/overall not a bad day		excited/nice day with good ideas to present to coach			neutral/fun day but didn't get everything done	

Table D2. Booklet Diary Results: Page 1

Participant 3/number of responses: 9						
day 1	day 2	day 3	day 4	day 5	day 6	
7/it's going ok	7/-	7/-	7/-	8/-	8/-	
neutral/calm relaxed meeting	bored/boring lecture no energy left	excited/excited about coming up with new ideas	tense/calm /tired from the weekend	irritated /because of the lecture	neutral/tired because of train	
8/we did some work		7/-			8/-	
cheerful		tense/end of work still stuff to do			excited/cheerful/happy start of day	
Participant 4/number of responses:9						
day 1	day 2	day 3	day 4	day 5	day 6	
6/we re a bit behind,lots to do	-/didn't work a project	7/we were working well	6/not everybody was present	7/didn't work on project	6/not everyone finished task	
calm/we don't need to stress yet,things should work out if we put some effort	irritated/crappy lectures	excited/ good?	irritated/ annoyed about subcourse assignment	irritated /really crappy lectures	tense/deadline's coming, lot's to do	
6/the day was not very productive		7/coach meeting was ok,still a lot to do			7/we made some progress, although slow	
bored/didn't do much		tense/discussion and burocratic incompetencies of faculty personnel			cheerful/had fun working today	

Table D3. Booklet Diary Results: Page 3

Participant 5/number of responses: 9					
day 1	day 2	day 3	day 4	day 5	day 6
8/we divided task, and now it's all clear and structured in my head	7/nothing changed with yesterday	8/at the start everything went well everybody did a lot of work	6/a little better but still same as Friday	5/still scared for the deadline	5/still scared, but excited to work
neutral/not feeling anything but i think it depends it maybe happy it depends on what happens	neutral/i ve calmed down a bit since yesterday	excited/because everybody works well	tense	tense/it's not good for my overall mood	excited/excited to change odds and go working
7/didn't do as much as i would liked		5/after coach meeting			7/ok we did a lot feels good
stressed/the perspective of the lots of work we have to do makes me scary and stressed.		irritated/coach meeting was so not useful and i got scared again of all the work we have to do			neutral/still a lot to do, but feeling better
Participant 6/Number of response:9					
day 1	day 2	day 3	day 4	day 5	day 6
7/project was a bit vague from the beginning	7/-	6/we didn't accomplish much so far today	8/task division, more productive	9/saw the model	5/i am overwhelmed but i think project is ok
Neutral/because i think we are quite on track but want to get feedback from the coach	Neutral/starting to get a little tense as due date Intern report is in 2 weeks	Cheerful/relaxed/ We have a good music playing and are making some progress slowly	Excited/while some were modeling others were making progress on report	Relaxed/even though we have the report for next week we have a model	Tense/i need to do a lot more work on my part of the project, others have been out of performing this week
7/had an ok coach meeting		9/nice afternoon spend outside.			6/average day ,didn't really think the project
Neutral/ but bored because of long meeting, but knowing what to do from how i think		Excited/finally really build a model, going in the right direction			Tense/lots going on being in the end of semester

# APPENDIX E

## INVITATION FOR EXPERIENCE SAMPLING STUDY

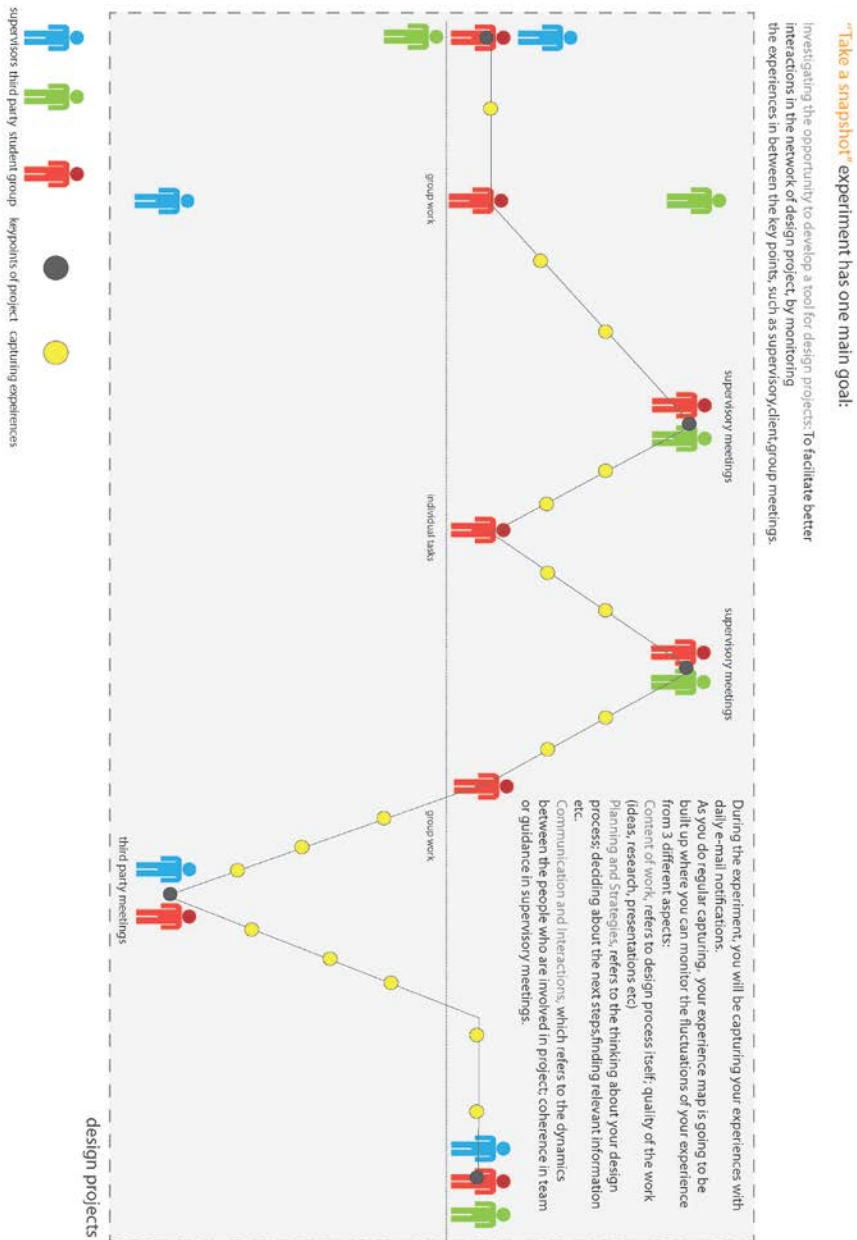


Figure E1. Poster prepared for invitation to Experience Sampling Study

# APPENDIX F

## NUMBER OF RESPONSES IN EXPERIENCE SAMPLING STUDY

*Table F1. Number and frequency of responses: Page 1*

	29	30	31	1	2	3	4	5	6	7	8	9	10	11
06.00-12.00	o	o				o		o	o					
12.00-18.00	o		o		oo		o						o	
18.00-00.00	o				o	o								

	29	30	31	1	2	3	4	5	6	7	8	9	10	11
06.00-12.00		o		o		o	o	o						o
12.00-18.00	o		o	o	o	o			o					
18.00-00.00		o												

06.00-12.00	o				o	ooo	ooo			oo				o
12.00-18.00		oo		ooo										
18.00-00.00							o	o						o

06.00-12.00		o												
12.00-18.00	o	o		oo		o	oo	o	o					
18.00-00.00			o		o	o	o			o				

	29	30	31	1	2	3	4	5	6	7	8	9	10	11
06.00-12.00		o		o					o					
12.00-18.00	o	o		o			o							
18.00-00.00						oo			o					

06.00-12.00	o	o			oo		o			o			o	
12.00-18.00					o								o	
18.00-00.00			o	o	o	oo								

06.00-12.00			o			o	o	o						
12.00-18.00		o	o	o										
18.00-00.00		oo			o				o					oo



Table F2. Number and frequency of responses: Page 2

	29	30	31	1	2	3	4	5	6	7	8	9	10	11
06.00-12.00		o				oo		oooo						
12.00-18.00	o		oo			o							oo	
18.00-00.00		o								o				o
06.00-12.00	o		oo			ooo	o	o						o
12.00-18.00		oo				o				o				
18.00-00.00														o
06.00-12.00	o		o	o			oo							
12.00-18.00		o						oo					o	o
18.00-00.00			o						oo					
06.00-12.00	o	o		oo		ooo	oo	oo	o					ooo
12.00-18.00			o											
18.00-00.00			o											
06.00-12.00	o			o				o	o					
12.00-18.00						oo								
18.00-00.00		o	o			o	o							
06.00-12.00		o		o										
12.00-18.00	o					ooooo	o							o
18.00-00.00			o							ooooooo				
	29	30	31	1	2	3	4	5	6	7	8	9	10	11
06.00-12.00			o					o						
12.00-18.00	o		o	o		o	o	o		o	o			o
18.00-00.00						o	o							o
06.00-12.00						oo		o			o			o
12.00-18.00	o	o				o								o
18.00-00.00			o	o		o	oo							
06.00-12.00		o	o					o	o	o				o
12.00-18.00	o			o		oo								
18.00-00.00		o		o		o				o				
	29	30	31	1	2	3	4	5	6	7	8	9	10	11
06.00-12.00				o		o		o	oo					o
12.00-18.00										o	o	o		
18.00-00.00	o	oo	o	o		o	oo			o				o
06.00-12.00		oo												
12.00-18.00			o		ooo		o							
18.00-00.00		o			o								o	o
06.00-12.00										oo				
12.00-18.00						ooo								
18.00-00.00	o	oo			oo				oo					



USER TEST	activity	WORKLOAD	variables
USER TEST	activity	WORKLOAD	variables
USERTEST	activity	WORKLOAD	variables
USERTEST	activity	ON TRACK	passive
WORK HARD	activity	DYNAMICS	passive
WORKLOAD	activity	ON TRACK	passive
WORKLOAD	activity	NO WORK	passive
WORKLOAD	activity	ON TRACK	passive
WORKLOAD	outcome	FEEDBACK	personal
WORKLOAD	outcome	ON TRACK	variables
WORKLOAD	outcome	NO WORK	variables
SCHEDULE	outcome	PERSONAL	variables
RESULTS	passive	NO WORK	variables
PLANNING	passive	ON TRACK	variables
NO WORK	passive	REFLECTION ON WORK	variables
PERSONAL	passive	NO WORK	variables
NO WORK	passive	NO WORK	variables
IDEA	personal	ON TRACK	variables
WORKING	personal	PLANNING	variables
NO WORK	variables	ON TRACK	variables
PERSONAL	variables	OUTCOME	variables
PROGRESS	variables	ON TRACK	variables
NO WORK	variables	ON TRACK	variables
NO WORK	variables	BUSY DAYS	variables
TIME PRESSURE	variables		
RESULTS	variables		
COORDINATION	variables		
COORDINATION	variables		
PLANNING	variables		
ACCOMPLISHMENT			

Figure G2. List of keywords: Page 2

LACK OF COMMUNICATION	variables
LACK OF COMMUNICATION	variables
MEETING	activity
MEETING	activity
MEETING	activity
MEETING	activity
MISCOMMUNICATION	variables
NICE GROUP	generic
NO CONFLICT	
NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
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NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
NO WORK	passive
NOT DISCUSSING	
PERSONAL	personal
PROBLEM SOLVING	
RESPONSIBILITY	variables
RESPONSIBILITY	variables
SCHEDULE	variables
SCHEDULE	variables
SCHEDULE	variables
STEADY	
TASK DIVISION	activity
TASK DIVISION	activity
TASK DIVISION	activity
TASK DIVISION	activity
TASK DIVISION	activity
TEAMWORK	activity
TIME PRESSURE	variables
TRUST	variables
UNDEFINED	activity
USER RESEARCH	activity

Figure G3. List of keywords: Page 3

COMMUNICATION/INTERACTIONS

ALONE/NO COMMUNICATION	variables
APPOINTMENTS	activity
BOUNDING	personal
BRAINSTORMING	activity
CHEMISTRY	variables
CHEMISTRY	variables
CHEMISTRY	variables
CHEMISTRY	variables
CHEMISTRY	variables
COACH FEEDBACK	outcome
COACH MEETING	activity
COACH MEETING	activity
COACH MEETING	activity
COACH MEETING	activity
COLLABORATION	variables
COLLABORATION	variables
COLLABORATION	variables
DECISIONS	outcome
DISCUSSING ISSUES	activity
DISCUSSING ISSUES	activity
DISCUSSING ISSUES	activity
DISCUSSING ISSUES	activity
DYNAMICS	variables
DYNAMICS	variables
DYNAMICS	variables
FREE	
FUN	generic
FUN	generic
FUN	generic
FUN	generic
GET ALONG	variables
GOOD TALKS	activity
GROUP ISSUES	
GROUP PERFORMANCE	
GROUP WORK	activity
GROUP WORK	activity
COLLABORATION	variables
COLLABORATION	variables
GROUP WORK	activity
GROUP WORK	activity
INDIVIDUAL WORK	activity
INDIVIDUAL WORK	activity
INDIVIDUAL WORK	activity
INDIVIDUAL WORK	activity
INDIVIDUAL WORK	activity
INTERACTION	
LACK OF COMMUNICATION	variables

Figure G4. List of keywords: Page 4

WORK DIVISION	activity
GENERIC	activity
E-MAIL CONTACT	generic
NO WORK	generic
DYNAMICS	generic
NO WORK	passive
CHEMISTRY	passive
NO WORK	passive
CHEMISTRY	passive
GENERIC	passive
NO WORK	variable
NO WORK	variable
DYNAMICS	variable
DYNAMICS	variable
CHEMISTRY	variable
GENERIC	variable
E-MAIL CONTACT	variable

Figure G5. List of keywords: Page 5