Lappeenranta University of Technology
School of Business and Management
Degree Program in Computer Science

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Investigating User Participation in the Design Process via a Social-media based Tool – a Systematic Mapping Study

Supervisor: Professor Ahmed Seffah

ABSTRACT

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Keywords: user participation, participatory design, social media-based tool, systematic mapping study, UXModeler

A systematic mapping study was conducted to investigate the influence of user participation in the design process via a social media-based tool. The initial search yielded in 365 papers from which we identified 11 unique ones appropriate to our study. We reviewed the articles in two steps. The first round based on inclusion and exclusion criteria result in 88 articles. The Second round was carried to validate the reason for keeping these papers. Finally, we focused on 11 full-text items for performing a deeper analysis. The result demonstrates that design process is a social phenomenon. Most papers report a positive correlation between the design process and social factors like the way of users participation, their interaction with designers, the importance of their culture on the design process and their user's influence in decision-making. A variety of user involvement practices through social media-based tools is revealed by the end of analyzing of papers. We also incorporated these elicited practices into a social media-based tool, called UXModeler, which aims at capturing, understanding and modeling users' experiences through engaging them in the design process.

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Thank you,
Masood

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LIST OF SYMBOLS AND ABBREVIATIONS

EDC	Engineering Design Communications
HCI	Human-Computer Interaction
MVC	Model-View-Control
NLP	Natural Language Processing
PD	Participatory Design
PICO	Population, Intervention, Comparison and Outcomes
PWA	Progressive Web Application
RWD	Responsive Web Design
SLR	Systematic Literature Review
SMG	Social Media Gateway
SMS	Systematic Mapping Study
SND	Social Network Database
SOA	Service Oriented Architecture
SUS	Service User Side
UCD	User Centered Design
UPI	User Participation and Involvement
UX	User Experience
UxD	User Experience Design

1 INTRODUCTION

This thesis investigates and reviews scientific papers related to the influence of user participation in a design process in software engineering. To do this, we carried out a systematic mapping study to find out which methods and practices are available in the literature.

Furthermore, we integrate our findings into a social media-based tool, called UXModeler and explore the possibility of combining this tool with crowdsourcing and living labs. Combining these two later approaches of large-scale user involvement let us study the potential advantages of developing a single platform which can help designers to extract and understand user experiences in a highly structured online environment.

Term “user participation” is regularly used to refer to aspects of user involvement and effects of it in the design process. “User Participation” is a common term in a variety of research areas. In the field of software engineering, it is used both in development life cycle or use life cycle.

To share a common understanding of the most frequent terms in our study, in this part, we provide a brief background.

1.1 Background

1.1.1 Participatory Design

There has been a steadily increasing movement among designers that indicates they have been interested in applying a “collective creativity” approach in their design processes. By this method, they let end-users to play an extremely vital role in designing the product they will be using it [1]. “Collective Creativity” in design which also called *participatory design (PD),* has been a known approach for at least 50 years. *“Democratization at work”* is the foundation of participatory design concept *[2]*.

Research on the techniques of user participation and its effects in the systems design started in Europe in the early 1970s. The idea of this movement sprang out in the Scandinavian countries where action researchers emphasized on the “intensive co-

operation” between investigators and participants. Participatory design focuses on human beings, making an effective relationship, and promoting creativity among participants.

Bjørn-Andersen and Hedberg [3] state three reasons for user participation:

1. Systems will be built based on better understanding of needs,
2. Users have a chance to express their expectations. They will also learn to be flexible to changes,
3. Spreading the spirit of democracy gives the collaborators a right to participate in making decisions by which their future work will be affected.

The participatory design aims to not only put the users in the focal point of the design process (user-centered design) but also to engage and move the end-users into the world of developers and researchers. It is recognized that participatory design provides an appropriate opportunity for designers to gain more accurate information about the business process. Knowing more about users leads to delivering software products with higher quality [4].

This movement has changed the role of participants [5]:

- During the initial iterations of the design process, end-users help to identify the problem and focus on potential solutions. During the development phase, they help with evaluating the proposed and implemented solutions. During this approach, the classical users are given the position of “expert of their experience” [6] which contribute by providing valuable knowledge, generating new ideas, and developing concepts. However, when a little briefing on the users' role be available on a design project, users become confused and concerned about their level of expertise [7]. Researchers found that before collaboration, it is important to properly train participants [4].
- On the other hand, researchers are no longer traditional communicators between expert designers and end-users. They get the role of facilitators who invite, involve, lead, guide and encourage future users into the design development process where the different levels of creativity are needed.

The changes in the users' role seem to be in contrast with the concept of professional and expert designers, but the fact is that professional designers are still in demand. They will not be disappeared overnight as 'users' become co-designers [8] because they provide expert knowledge that the other stakeholders do not have. They are good at visual thinking, conducting creative processes, finding missing information, and being able to make necessary decisions in the absence of complete information.
Furthermore, it is widely accepted that an early and ongoing involvement of users in a system design is of high importance. Active involvement in processes and procedures of design ensures that the final output of the design process meets exact needs of all stakeholders. It is proved that keeping the close connection between who are profited from outcomes of design will provide added-value in the system [1].

However, there are grave concerns about who are the most suitable candidates, when they might involved, and what role they may take in the design process [5], [9]. In practice, some critical challenges such as: contacting and selecting users, motivating users, facilitating and mediating meetings and offering points of focus for user contributions [10] should be addressed [11].

1.1.2 Social Media as a tool

During recent years, social software infrastructures like YouTube, Facebook and Flickr have been extremely busy developing and promoting platforms for civic participation. By joining this sort of online community, a user(citizen) will be able to create and share an experience across small and large, homogeneous and heterogeneous communities which immediately may be supported, discussed or extended by the others [2]. This potentiality provides a democratic process which enables users and citizens to connect to each other and quickly access shared information through the active participation which takes place in a huge and globally connected community.

Studies show that users are satisfied with communicating of their opinions within a heterogeneous group of their friends. They can have a dramatic influence on the success of a software system, especially when they feel their ideas and their voices are important; otherwise, they may even try to hurt the reputation of the software.

On the other hand, companies are also interested in user feedback to improve or even invent new products and services. Building an adequate systematic method for involving users from a different background to gather and monitor their valuable experience is a major step in engineering software. Thus, socialness of software, which means "the degree of involvement of expert users and their communities during software life-cycle" [12], could be considered as an essential approach in design iterations.

Online communities can break the barriers of time, space, and scale of those limited off-line interactions [13]. These kinds of societies increasingly allow a larger number of end-users to participate in a collaborative process of a software development and design [14], [15].

1.2 Research Objectives and Questions

"The underlying questions of research provide valuable information to decide whether the topic is relevant, researchable, and significant"[16]. Developing a researchable question was one of our challenging tasks.

Since there is a sharp increase in the number of published reports and results in the field of our interest, the main goal underlying our work is to summarize and offer an overview of studies that have already taken place. We will present the statistical evidence of scientific papers that are available to scientific communities.

In this study, we are going to summarize existing information and research studies on the active participation of users in a design process via social media-based collaboration tools. For this, we decided to undertake a Systematic Mapping Study (SMS) to get a better insight of what is in our hand. Furthermore, we try to apply our findings to a social media-based tool named, UXModeler in order to develop a new version of it.

Our primary objectives in this research are:

1. Conduct a systematic mapping study to understand how social media can be a tool for supporting user participation in design process?
2. Explore the reported effects of user participation in design process.

3. Make functional improvement of a social media-based tool called UXModeler, by applying the results of our study which suggests recommendations for possible extensions of such tool.

Based on these, and to discover the research trends, our mapping study focuses on the following research questions:

RQ1: How social media can be a tool for supporting user involvement/participation?

RQ2: What effects of user participation in the design process via social media have been reported?

RQ3: In which scientific forums and communities the topic of our interest has been discussed?

RQ4: Which further studies would be needed on increasing user participations via a social media-based tool?

1.3 Rationale for Performing a Systematic Mapping Study

Based on the purposes of our research, it seems that a *Systematic Mapping Study (SMS)* is an appropriate approach for collecting and analyze the data. Since our aim is to explore and look at the previously researched area, we will use an inductive approach which is associated with qualitative research. The inductive approach helps us to establish the facts based on our observations [17]. Thomas [18] states that researchers follow three primary objectives by taking an inductive approach. They include:

1. Observe and summarize raw textual data;
2. Discover and clearly express the relationship between research questions and the research findings;
3. Develop a framework for generalizing these relationships

We believe that these characteristics of the inductive approach reasonably fit our goals.

1.4 Structure of the thesis

This thesis is prepared in five main chapters. The first chapter provides a brief introduction as well as a background from previous researches in this subject: the research questions, objectives and key concepts (participatory design, user experience, usability, design, UX and usability and social media as a tool) are introduced. In addition, the necessity of doing a systematic mapping study is explained there.

Chapter 2 describes our research methodology by presenting the way we constructed the search strings and how we extracted the data. In more details, firstly, systematic mapping study is defined briefly. Then, the proposed method is described by stating search strategy, terms, sources and queries. The procedure of scanning papers and selecting the relevant ones is described as next step. Finally, the methods applied for analyzing and classifying the extracted data is explained.

Chapter 3 explains the outcome of mapping study and visualizes the obtained result related to each research question. We classify our result into different categories to answer our research questions more precisely. We also present some illustration related to eliciting trends of our research topic. The closing section of chapter three is done by discussing possible future studies.

In chapter 4, the application of UXModeler as a platform to provide a good understanding as well as the best modeling of user experience is described. Furthermore, an investigation about the building blocks of UXModeler is described and some important technical considerations about the architecture of UXModeler is mentioned in this chapter.

At the end, as a conclusion we present a summary of our work.

2 RESEARCH METHODOLOGY

2.1 Systematic Mapping Study

In software engineering conducting a Systematic Mapping Study (SMS) is mainly suitable for research fields in which evidence of "a lack of relevant, high-quality primary studies" exists [19].

Systematic mapping studies or scoping studies give an overview of a research area through classification and counting contributions of that class [20]. In other words, it is a tool for unbiased categorizing and summarizing the existing information about the research question [21]. It involves searching the pieces of literature to find out what research topics they have covered? Moreover, in which scientific sources they are published [22]? Thus, categorizing of papers can be done by applying criteria such as type, forum, and frequency.

Petersen et al. [20] suggest an updated version of a proposed guideline for conducting a systematic mapping study in software engineering. Figure 1 illustrates the main steps of SMS. The essential process steps are [20], [22]:

1. Defining of research questions
2. Conducting the search for relevant papers
3. Screening of papers (selecting and assessing quality)
4. Data Extraction (key-wording and summarizing)
5. Analyzing and classification
6. Validity evaluation
7. Mapping and visualizing the results

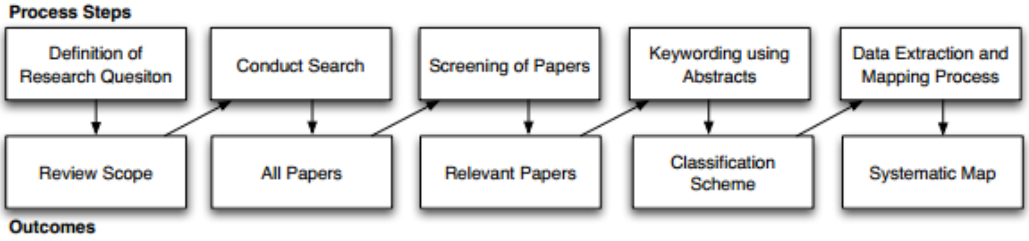

Figure 1: The Systematic Mapping Study Process [22]

Often, systematic mapping study results will be summarized using visual layouts like diagrams, charts, and tables. Among graphical representation which is "an effective reporting mechanism" [19], bubble plots are more useful because it allows merging categories with each other and thus the relative emphasis of research on each category is visible from the plot itself [22].

In sum, it is important to mention that goals, broadness, and depth of a study are three key features that make a systematic mapping study different from Systematic Literature Review (SLR). These two methods might be used complementary. First, to have a high-level overview of the topic area, a systematic map may be performed, then using a systematic literature review a deeper exploration can be executed to present a better demonstration of the research topic [22]. Bellow we list some benefits of such an approach:

1. Saving time,
2. Gaining useful insights for the future direction of the same research area [19],
3. Identifying the research gaps,
4. Knowing the trends of the study topics using a visualized presentation,
5. Obtaining a reliable set of references of the related works [22]–[24].

2.2 Proposed Method

The conducted systematic mapping study reviews the existing literature in HCI domain. It particularly seeks for the best practices of user participation and their active contributions with designers in a social media-based collaboration environment.

In order to answer our research questions which we previously mentioned in section 1.3, we developed a protocol based on guidelines described by Petersen et al. [20]. The guideline shows how to conduct a systematic mapping study in software engineering. It covers different processes of a systematic mapping study including search, study selection, analysis and presenting extracted data. Beside this, we also used Durham template[1] for performing mapping study in software engineering.

1 http://community.dur.ac.uk/ebse/resources/templates/MappingStudyTemplate.pdf

In this section we explain the steps which are needed for conducting our systematic mapping study. The main activities are grouped into three stages which are planning, conducting and reporting.

1. **Planning**
    - Motivate the need for this study
    - Determine the scope of the study
    - Define research questions
2. **Conducting**
    - Specify the search strategy, find search-terms and choose the collection of search-sources
    - Identify inclusion and exclusion criteria (the selection criteria)
    - Identify the data extraction process from the articles and how to validate them
    - Do the real search
3. **Reporting**
    - Decide which diagram is more relevant for reporting
    - Present the results
    - Explain study limitations

2.3 Search

2.3.1 Search Sources

Scientific databases and electronic resources index the major part of the international academic papers, peer-reviewed journals, and conference proceedings. They include a search engine for retrieving and accessing the articles. They also offer an advanced search panel which helps researchers to narrow the output of their search queries based on their interest.

Dybå et al. [25] introduce eight electronic sources and indexing services as the most relevant databases for software engineering research. We conducted our literature searches in five of them. They are:

1. ACM Digital Library
2. IEEE Xplore

3. ScienceDirect – Elsevier
4. Scopus Indexing Service
5. SpringerLink

We used *advanced search* to narrow the outputs and get more specific and relevant results. This helped us to apply some exclusion criteria at the same time. Our exclusion criteria are defined based on some common practical issues including but not limited to language, date of publication, and type of publication(journal, article). We will discuss our exclusion criteria in section 2.4.2.

2.3.2 Search Strategy

To do our search in scientific databases, we have to find the best possible keywords and formulate them into a search string. Our research questions, presented in section 1.2, have some keywords that are suitable for constructing a search query. We realized that PICO is a suitable strategy for this purpose.

PICO stands for Population (or Problem), Intervention (or Indicator), Comparison (or Control) and Outcomes. Medical researcher widely apply PICO search strategy to frame a research question [26]. The idea is to break down a question into four main components in order to facilitate the process of identification and extracting of the relevant information. Kitchenham and Charters [19] suggest the same idea in the domain of software engineering.

The four components of PICO and the way we use them are as following:

1. *Population* or problem refers to a class or application area in which researcher are interested to do their study. In our case, population would be participatory design. Likely, it is not a realistic goal to find and analyze all articles in this domain so we try to focus on a good sample of all available articles which seems to be suitable and enough.
2. *Intervention* refers to methods, technologies, tools or procedures by which a researcher may plan to study the effects of their presence on the population. In our study we focus on the role of social networks in user's collaborations with designers and investigate tools which are based on social-media framework.

3. *Comparison* is useful when researchers aim to compare different intervention with each others. Assessment and comparing different approaches is not our primary goal in our study so we do not execute empirical comparison between existence alternatives in our study.
4. *Outcome* is the influence of social media in user participation and design process. Because we do not focus on evaluation, we have not measurable outcomes. We only present the research trends in form of an inventory of papers on the topic area which are visually mapped to a classification [20].

2.3.3 Search Terms

We identified six separated groups of keywords and introduced them as our search terms based on their strength, their weakness, their synonyms and their related words. Table 1 shows our search terms. Conjunction of search terms using search operators(AND, OR) made our final search strings.

Table 1: Search Terms, Synonyms or related terms

Group		*PICO*
1	Participation OR Involvement	
2	Social Media OR Social Network OR On-line Community	Intervention
3	User OR Designer	
4	Software Engineering	Population
5	Tool OR Framework OR Platform OR Infrastructure	
6	Design Process OR Participatory Design	Population

2.3.4 Search Queries

For each database source, a specific search query has been applied. Table 2 summarize all the search strings and the database in which the search query has been run.

Table 2: Search Queries

Database	Search String
ACM Digital Library	*("participation" "involvement" "tool" "framework" "infrastructure" "platform" "user" "designer" "social network" "online community" "software" "design process" "participatory design") AND acmdlTitle:(+"social media" +"design")*
IEEE Xplore	*(("Document Title":design AND "Document Title":"social media") And ("Abstract" OR "Abstract":"participatory design" OR "Abstract":participation OR "Abstract":"online community" OR "Abstract":"social network" OR "Abstract":designer) AND p_Abstract:user AND ("Abstract":tool OR "Abstract":framework OR "Abstract":platform OR "Abstract":infrastructure) AND "software engineering")*
ScienceDirect - Elsevier	*docsubtype(FLA) and pub-date > 2010 and ("social media" participation design) and (tool or infrastructure or platform or framework or involvement or user or "social network" or "participatory design" or "online community" or software or designer)AND LIMIT-TO(cids, "271802,272548,271629","Computers in Human Behavior,International Journal of Human-Computer Studies,Journal of Systems and Software") AND LIMIT-TO(topics, "social network,participant,community")*
Scopus Indexing Service	*TITLE (participation OR "social media") AND TITLE(design) AND ABS(involvement OR user OR designer OR "social network" OR "online community" OR software OR tool OR framework OR infrastructure OR "design process" OR "participatory design") AND DOCTYPE(ar OR cp) AND SUBJAREA(comp) AND PUBYEAR>2011 AND (LIMIT-TO(EXACTKEYWORD , "Design") OR LIMIT-TO (EXACTKEYWORD , "Software Engineering") OR LIMIT-TO (EXACTKEYWORD , "Human Computer Interaction") OR LIMIT-TO (EXACTKEYWORD , "Computer Software") OR LIMIT-TO (EXACTKEYWORD , "Computer Science"))*
SpringerLink	*design AND participation AND "social media" AND (user OR "social network" OR "participatory design" OR "online community" OR involvement OR "design process" OR designer)*

2.3.5 Conducting a Trial Search

We decided to run a trial round before retrieving the main search result sets. Performing a trial search helps us to refine our search terms more accurately and at the same time to make sure that we can access to enough articles in our selected scientific sources.

We also tried to learn how to use the *advanced search panel* in each database. Advanced search allowed us to eliminate unwanted results based on our criteria, focus on more specific results, and save time.

After we strengthened our search terms and get assured about choosing right scientific sources, we performed our main search to create our primary results set. We used *Zotero* for collecting and organizing our research sources. It also allowed us to find and remove duplicates.

Table 3 displays the number of search result per electronic database. The searches took place on summer and autumn of 2016. In total, we retrieved 365 papers. We aimed to a smaller set of papers that enables us to carry out the analyzing phase of our systematic mapping study more effectively. This made us to think about more exclusion criteria.

Table 3: Number Of Primary Studies Found In Databases

Database	*Number of returned Results*
ACM Digital Library	50
Scopus indexing system	48
IEEE Xplore	141
ScienceDirect – Elsevier	53
SpringerLink – Springer	173
Total	**365**

2.4 Screening Papers and Selection Procedure

Our experience on trial search showed that even after using *advanced search* option of an electronic database, still numerous part of returned studies are completely irrelevant; either to the research domain or to the research questions. So it became necessary to put some criteria on primary results set. The aim was to work only on those studies which has "direct evidence about the research question" [19].

2.4.1 Assessing the Relevance of the Papers

It is important to correctly measure the relevance of each selected article to the research goals. To keep an identical way during the measurement process, we developed five questions which helped us to evaluate the relevance of the papers:

1. Does the paper define the concept of *User Participation, User Involvement , Participatory Design* and *social media*?
2. Does the article, employ the concept of *User Participation* during a *Design Process*?
3. Does the paper utilize at least one *social media-based tool* for conducting its study?
4. Does the document present *the effects* of using that tool?
5. Is the original context of the article one of these three disciplines *Computer Science, Software Engineering or Human-computer Interaction*?

For each paper, we sum the numeric value of possible answers to these questions and calculated the relevance grade for each paper. Our relevance grade is a number between 0 and 5. The possible answers and their numeric value are:

1. When the answer to a question is YES, then the value of the answer is set to 1;
2. When the question is partially answered or the answer is NO, then the value of that answer is set to 0.5;
3. When the answer is not satisfactory at all, the value is 0;

We decided to keep only those documents which achieved grade 2 or more. Table 4 summarizes the grade of each paper.

Table 4: The Relevance Grade Of Final Selected Studies

	Study Title	***Grade***
1	*A Social Media framework to support Engineering Design Communication*	2.5
2	*From participatory design to co-creation: Using social media to engage youth*	5
3	*Involving users in the wild—Participatory product development in and with online communities*	4.5
4	*Lessons for Participatory Designers of Social Media: Long-term User Involvement Strategies in Industry*	5
5	*Re-considering Participation in Social Media Designs*	3.5
6	*Social Media As a Platform for Participatory Design*	3.5

	Study Title	Grade
7	*Social Media As Ad Hoc Design Collaboration Tools*	2
8	*Social Media Resources for Participative Design Research*	3.5
9	*Social Media, Design and Civic Engagement by Youth: A Cultural View*	3
10	*TweetSpiration: Leveraging Social Media for Design Inspiration*	2.5
11	*UDesignIt: Towards Social Media for Community-driven Design*	2

2.4.2 Exclusion and Inclusion Criteria:

We needed to exclude some publications out of our collected papers and make a smaller set in order to make a proper analysis applicable. As part of process of preparing the SMS protocol, we defined some exclusion and inclusion criteria. Later, the result of performing the real search made it clear that it is necessary to refine some of our criteria in a more effective way.

Our exclusion criteria are listed bellow:

1. We removed non-English papers.
2. We focused only on those papers which were presented in full-text.
3. We restricted the search result to those articles in journals and conference publications which are published and accessible through online databases. Printed versions of papers and books has been omitted.
4. The same papers (Duplicates) which were accessible through different databases were removed.
5. We bounded our search to *Computer Science and Software Engineering.* Wherever it was possible, we make it more restricted to *Human-Computer Interaction (HCI)* domains.
6. We were interested in the most recent papers (last five years plus 2016). Since we performed our search on 2016, we excluded all articles that were published before 2011.

We conducted two exclusion rounds based on the title, abstract and introduction section of each papers. Brereton at al. [27] during a study claimed that in the domain of software

engineering "The quality of abstracts is poor; it is usually not possible to judge the relevance of a study from a review of the abstract alone" so to keep more relevant papers, in some cases, we also considered the conclusion parts.

Presenting a reliable systematic map needs avoiding bias while reviewing the papers for applying exclusion and inclusion criteria. Since only one researcher completed this thesis, so one important challenge that we faced during this step was to decide how to treat all papers equally. In most of the cases, we relied on the discussion with our colleague and also our supervisor's feedback [19]. At the end of exclusion and inclusion round only 11 remained. Table 5 shows the number of papers during the selection process.

Table 5: Paper Screening Progress

Database	*Number of returned Results*	*Primary Set Potentially Relevant*	*Final Set After applying exclusion*
ACM Digital Library	50	27	8
Scopus indexing system	48	30	2
IEEE Xplore	141	16	0
ScienceDirect – Elsevier	53	9	1
SpringerLink – Springer	173	6	0
Total	**365**	**88**	**11**

Appendix 1 includes the final list of our selected studies and their abstracts. Kitchenham and Charters [19] recommend maintaining and presenting a list of excluded articles in which the reason of exclusion is expressed. We excluded many papers because they were irrelevant to our study. We present the list of excluded studies in the Appendix 2.

2.5 Performing the Exclusion

Online advanced search in our target databases yielded in 365 publications. These are too many for doing our analysis. We decided to conduct two exclusion rounds based on the title and the abstract, introduction and conclusion sections of the papers.

In the first exclusion round, papers were excluded if they were out of the context of software engineering or HCI. For example, many papers considered social media as a tool for collecting data, extracting positive and negative user experiences, distributing

information between citizens who were stuck in a natural disaster condition. Some others used social media for promoting social connections and awareness between citizens not to involve them in a design process. Social media also used as a helpful tool during learning activities like improving the writing abilities of children at school age. Also, we found that some papers were presented only in a poster format and were unsuitable for our study. Applying the exclusion criteria made 277 papers out of our initial set.

Since the quality of information technology and software engineering abstracts is not very high [27], for our next round of exclusion we consciously considered the introduction and conclusion sections. At the end of this round, out of 88 existing articles we ended up with 11 papers which seemed most relevant to our main analysis.

2.6 Preventing Bias in Data Extraction

In systematic mapping studies, it is a good practice to do the extraction process by more than one researcher in a way that at least one person extracts the information based on the defined protocol, and another one can control and check the extracted data [27]. We had not this opportunity to reduce the bias. In most of the cases, we relied on the discussion with our colleague and also our supervisor's feedback [19]

3 MAPPING STUDY AND VISUALIZATION

3.1 Social Media as Supporting Tool

In this section we classify our findings in order to present an answer to our first research question. We aimed to clarify "***How social media can be a tool for supporting user involvement and user participation during design process?"***

Our results show that social media can form a possible environment for collaboration. Social media-based communities facilitate design communications by providing powerful channels for exchanging almost all kinds of users data in different formats. Accumulating user-generated data using a social media-based tool shapes a great source of resources. Designers not only can benefit from analyzing a large amount of shared data but also they can enjoy from lots of ideas, insights, and inspirations which enable them to deliver high-quality designs. Furthermore, social media has changed the role of designers as participants and vice versa. This capability offers a great opportunity for designers to explore the cultural context of people's everyday life while empowering users to influence the decision-making process.

In this section we present our classified results in nine categories:

3.1.1 A Suitable Platform For Supporting Design Communications

Gopsill et al. [28] argue that social media is a suitable tool for lightweight synchronous and asynchronous communications that enables users to freely express themselves, share knowledge, and discuss the topics of their common interest using either textual contents or other "richer media."

Furthermore, the possibility of representing high-quality artifacts related to the communication and other essential capabilities like tagging functionality are useful ways of engaging users to become active contributors to a design process and continuing the discussion.

They presented a theoretical social media-based platform for enabling engineering design communications (EDC). They strengthened their framework based on twenty requirements that they extracted from an extensive literature review. Table 6 in chapter four shows a list of these elicited requirements.

3.1.2 Suggesting Online Collaborative Environment

Internet has opened a new space for design practices where a "network of stakeholders collaboratively pursuing innovation". Alcántara at al. [29] discussed that the popularity of the Internet and its mobile accessibility make it a suitable infrastructure to support online collaborations in distributed design process.

However, large-scale collaboration of users [30] in an unstructured environment, where heterogeneous users are geographically dispersed "can be very complex and tedious" [31].

3.1.3 A Rich Source Of Inspiration

People are a great source of ideas. They generate and share a great amount of data, and their ideas, during each session of their social activities. Majority of social media services are based on the web and enable users to interact over the Internet infrastructure so user-generated data is located on the web.

In the other hands, "randomness" and "resourcefulness" are two characteristics of web that persuade designers to use it as a big inspiration source [32], [33]. However, the problem is that performing a single query on a web-based search engine may yield either in too many irrelevant data or too specific ones [33].

As an attempt, Herring et al. [33] prototyped *TweetSpiration* as a social media-based tool which helped designers to "develop new search terms" and "look for new search directions" whenever they "mentally stuck in a search session".

TweetSpiration accepts a term as a topic and tries to filter contents of published tweets and returns the 150 most recent tweets containing the given terms. It also presents a "word cloud" which is a visualized map of "most frequent socially derived words". Word cloud

helps designers to discover the connections between the given topic and suggested words [33].

3.1.4 A Source Of Resources

Researchers consider social media as "a source of resources" [34] during participatory design approaches. The aim is to promote various ways of visual and textual interactions between participants.

As an example, Qaed et al. [34] in a participatory design research used existing social media platforms to develop a tool named *Classroom Design Recipe.* This tool helps teachers to redesign learning spaces and help them "redesign their experiences" and perceptions about learning spaces in their workplace.

3.1.5 Empowering Users To Analysis Social Data

Online social networks technologies are able to gather many people in a very quick, easy, and cheap way. Using social media enables people to interact with each other and exchange data. Synthesizing of social media data is a useful mechanism for understanding meaningful relationships between co-related issues within a society.

Considering these potentials, Greenwood et al. [35] claim that current approaches of utilizing social media only let users to express their opinions without empowering them to analyze their data. To remove this shortage, they developed a social media-based tool named *UDesignIt* which aims at "large-scale participatory design". Indeed, they suggest to use social media as a tool for revealing the hidden patterns of user-generated data.

UDesignIt aims to "directly extract specific design information" from the discussion which have taken place in the context of an online social network. *UDesignIt* combined the Natural Language Processing (NLP) and Feature Modeling within a single platform which is able to automatically identify, group, name and visualize key themes of a text-based discussion. These key themes reflect the ideas and opinions of participants in real-time [35].

3.1.6 Defining A New Role For Designers As Participants

One way of understanding people's everyday practices is "to define designers as participants" [36] not the other way around. This new way of thinking leads to reconstructing the social distances between designers and users.

Social distance refers to three main points of relationship between designers and users. First, it implies formal "*differences*" among the role of designers and other participants. Second, It refers to the level of "*participation"* of users during design process (designers participation in use practices also could be considered). And third, it highlights "*Mediator"* role of social media technologies for supporting indirect contact between designers and users [30].

Johnson and Hyysalo [30] studied a large-scale participatory design project named *Habbo* which is a social media-based game service aim at children and teenagers. They discussed that it is crucially important to make the "developer-user social distance" as small as possible.

Directing attention to "developer's experiences and personal engagement" and empowering user-created communities with the "decision power" can effectively help to realizing correct direction of design and suggests better approaches for engaging users to participate in design activities.

3.1.7 Understanding People's Culture To Engage Them To Participate

Focusing on people's culture help designers to have a better perception of differences, contrasts, resistance, oppositions, and tensions. However, identifying how to engage, support and manage people in a "co-creation environment" is a significant milestone in participatory design [31].

In their study, Mainsah and Morrison [37] claim that there is not enough investigation on "the design of social media as offering socio-technical and communicative affordances in a cultural setting." They stated that design is a "cultural practice" and discovering people's history, politics and power as cultural considerations help to understand what people do and what motivate them.

Mainsah and Morrison [37] argue that social media as cultural tools of communications operate in "a specific cultural context" that enable the process of engagement. Based on Jenkins [38] that introduced "participation as a property of culture," in their study, Mainsah and Morrison focused on the social media, design and civic engagement by youth and stated that "we need to understand cultural context in existing youth participatory culture." They believed that "cultural perspective on design offers a unique understanding of how youth people engage with communication technologies."

In another project study named *Akerselva Digitalt (ADi)*, Stuedahl and Lowe [36] conducted some practical design experiments and tried to apply participatory design approaches in order to find out "how to foster participation in encounters between museum content and people in everyday situations." Their study highlighted that the process of attracting people in participatory design needs a deep understanding of people's culture and their daily practices.

3.1.8 Already-Established Social Media Infrastructures As Tool

Existing social media infrastructures can also support user participation in design process. Studies showed that there are some advantages and disadvantages of utilizing current social media platforms for supporting participatory design. Facebook, Twitter, Pinterest, WhatsApp, Instagram and Flicker are among well-established, widely-used social media network which have this potential.

As an example, Facebook has provided a strong base for informal social contacts. It offers a common infrastructure by which a team of designers can benefit from low implementation cost, ease of use and ease of learning. Alcántara at al. claimed that designers often use Facebook as a natural tool for their collaboration [29].

In another study, Reyes and Finken [39] invited a "heterogeneous composition of people" to participate in a three-weeks-long online workshop. They utilized Facebook as a potential platform for participatory design. In their case study, a distributed group of participants were encouraged to share their ideas for a new mobile application for cultural heritage, post comments on existing solutions, and critique other's comments. Their study showed

that using an existing infrastructure can be helpful to tackle the challenges of attracting users to a new online environment [40].

However, Johnson and Hyysalo [30] discussed that “little transparency” and “great power of asymmetry between developers and users” are among two main issues of current social media services.

3.2 The Influences Of Utilizing Social Media-Based Tools

This section discusses the influences of utilizing social media-based tools during user participation in a design process.

We extracted some direct and indirect effects of using social media as a possible, online environment for user contribution. This section lists the most highlighted ones. Also, some researchers have reported challenges of social media-based tools during their experiments or have suggested considering challenging issues. At the end of this section, we present a list of relevant ones.

3.2.1 Leveraging User Participation And User Engagement

Advantages of using social media as a collaboration environment make user more engaged in the process of participation. However, Engaging participants, particularly youth, to act as co-creator is a fundamental challenge to the design process, but Fisher and Jensen [31] reported that "a far greater level of engagement" has been achieved during their experiment on the project of Pacific youth engagement through social media.

These researchers worked on a real case project of participatory design leading by UNICEF which was aware of social media as a valuable communication channel. The aim was to benefit from the potential of this channel to distribute information regarding climate changes and its effects on Pacific region for as many people as possible. They asked Pacific children and youth, who were fans of UNICEF Facebook page, to join and collaborate on activities of designing a game called *Pacific Climate Change*. The ultimate target of the game was to encourage players to think about climate change effectively. They demonstrated that "it is possible to co-create and collaborate across distances and time successfully; it is possible to motivate and engage a wide range of people." [31]

In other study, Greenwood at al. [35] claim that social media-based tool, in their case *UDeginIt,* can leverage user participation and user engagement on a very large scale.

It is important to mention that, researchers suggested that the complex nature of relationships and communications between users and designers in a social media context

may be addressed by utilizing some methods of user engagement. However, Hess et al. [9] mentioned that “social media on their own will not address the problem of complexity.”

3.2.2 Affecting Decision Making Process

Studies show that empowering participatory design by social media-based tool implies a “large population of heterogeneous and globally distributed users” which follow “a range of personal and institutional purposes” and collaboratively share and discuss their ideas and concepts in an environment. It is proved that the goal of participatory design process is to extend the relationship between users and designers in a way that they can have a “strong influence on the process of design and decision process.” [9], [30], [31].

3.2.3 Human Factors Of Social Media Participation

Experiences of applying social media-based tools in design process highlighted the importance of human factor as a practical aspect of social media. The ultimate output of design process will be used by the human, so the inclusion of users and their relationship within their communities promote a high potential to support the design process. Designers can involve users during the different stage of the process.

The human perspective of design typically includes personal involvement and social commitment. Personal user involvement indicates various ways of information exchanges between an individual user and designers. Analyzing gathered data can help designers to be able to suggest better usability which means finding and developing some easy and intuitive ways for using a particular design. Social Involvement should cover users (citizens), designers, their communities and all interactions between them. A social media-based tool aims to engage users for a full involvement. In this kind of design activities, users are willing to actively extend the participation by creating a large community of their friends and followers.

In a study, Herring and her colleagues experienced developing a tool called *TweetSpiration* [33] and showed that exploring within the user-generated contents on online social networks “provides a new perspective on the design problems”. This is because data generated and published by participants offers a new perspective of the problem domain.

3.2.4 Reveal of Problems And Solutions

Participants using social media can offer their opinions around a mutual interest using "rich visual and textual materials." Collecting and monitoring user-generated data reveals valuable "examples of problems and solutions" around user's need. This kind of data indicates what users do, what users say and what users make for overcoming their problems.

3.2.5 An Opportunity for Users to Learn and Redesign their Experience

Users interactions within a social media and the possibility of sharing a broad range of insights, contents, and inspirations extend an ideal environment in which participants have this opportunity to "learn from each other" and "redesign their experiences." Their communications and interactions often lead to "valuable design knowledge" which provides "design opportunities" and rapid prototyping of practical and meaningful design.

3.2.6 Challenges and Considerations

Social media can offer a convenient way for gathering user's perceptions, user's practices and user's experiences especially when different participants are distributed all over the world [34]. Members of social media vary regarding age range, gender, culture, country, education, and skill background. Heterogeneity of users indicates that users may have a different level of expertise and can take different roles and responsibilities but the number of participants should be limited to a representative and manageable way [9]. This broad distribution can overcome unexpected challenges caused by geographical obstacles and cultural boundaries. In this section, we present a list of difficulties and consideration that have been reported by the researchers of our final set of papers in our SMS.

Reyes and Finken [39] stated that "the ability to critique, comment, share ideas, and interact participants got direct access to influence the design". Some of their findings are listed here:

1. On a public network like Facebook, people prefer spending their time for "relaxing rather than working".
2. Present participants does not imply active participants.
3. Participation through mobile phones showed that people have an interest of "carrying the space of participation"

4. Different expertise level of participants caused some of them lose their confidence. To make them active again, “extra encouragement” by facilitators was needed. This fact indicates that facilitating the process of participation in an online environment is vital.
5. Asynchronous communications is a characteristic of an online design environment. This forces participants to wait a longer time before they receive a response from their colleagues. When this happens, participants lose their willing for contribution and feel stuck in a boring activity.

In other words, lots of challenges should be addressed to structure, moderate and scale the process of participation. These issues have a direct impact on design success or failure. Fisher and Jensen [31] mentioned some factors which affect “successful co-creation of software in an unstructured, dynamic, and virtual environment.” Other researchers [9], [30] also present a list of significant problems that should be solved carefully. Some of these challenges and factors are listed bellow:

1. Knowing the characteristics and roles of users
2. Constructing representative and manageable communities of participant
3. Address the large amount of ideas and opinions in order to make a clear list of decisions
4. Using tools in order to mediate and structure the complexity of relationships and communications between users and designers
5. Managing significant differences in background knowledge, skill level, motivations, expectations and perceptions of risks among users and other stakeholders
6. Evaluating the level of satisfaction of users and other stakeholders
7. Cumulating user knowledge and managing user-generated contents

Hess et al. [9] expressed that to deal with the challenges and problems of participatory design two kinds of “inter-related management” would be needed: management of heterogeneity and administration of tools.

3.3 Reporting Trends

As it is mentioned in section 2.1, a systematic mapping study is a tool for categorizing, summarizing and counting the contribution of published papers around a research topic in scientific society [20]–[22]. In this part we aim to demonstrate the trends in our study. Particularly we answer our third research question which asked for ***In which scientific forums and communities the result have been published?***

Study trends include the total number of articles in the first round of electronic search, distribution of selected papers based on the source, distribution of selected papers per year, the ratio of papers depending on the type of document, and the countries in which study has been conducted.

3.3.1 Initial Search Using Online Scientific Search Engines

As it is mentioned in section 2.3.1, we explored five databases to find relevant studies. An overview about the proportion of each electronic source is provided in Figure 2. It can be seen that the majority of articles are acquired through Springer and IEEE database with about 37% and 30% respectively. Most of the papers provided by these databases are in conference venue with high ranking. The remaining articles are obtained almost equally from ACM, Scopus and ScienceDirect indexing systems. Overall, we tried to explore the most important existing electronic sources and databases [25] to find relevant studies with the highest quality and validity.

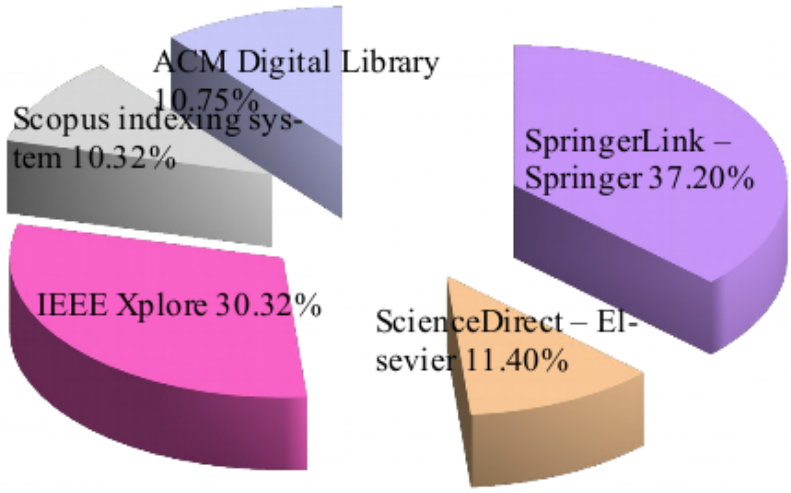

Figure 2: Initial Search Using Online Scientific Search Engines

3.3.2 Distribution of Articles Per Year

Figure 3 shows the distribution of published articles during last six years including 2016. It seems during 2011 to 2013; this subject was of the most interesting topics to researchers as we have the highest number of papers during 2012 and 2013 by four and three articles respectively.

After that, although we have a moderate decrease in general trend, there are almost a fix number of articles, at least 1 article per year. Despite that, it can be a signal revealing the difficulties in progress and development in this specific subject; the fact that each year we have some studies on this topic indicates that it is yet an open issue and is on demand.

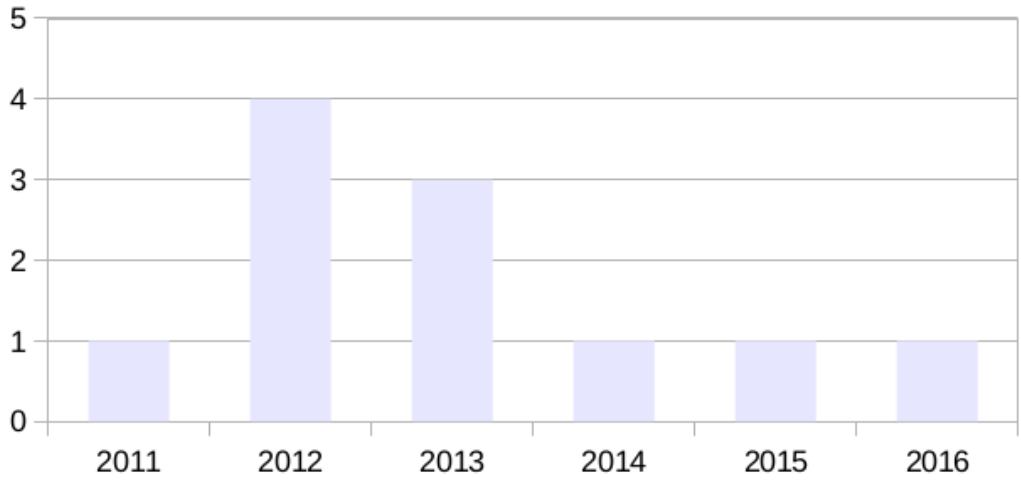

Figure 3: Distribution of Articles Per Year

3.3.3 The Ratio of Publications Type

In this research, all related papers are considered including peer-reviewed venues and conferences. The proportion of scientific journals and international conferences in selected articles can be seen in Figure 4. No surprisingly and similar to any other subject, the conference papers have the most portion of articles, about 81 %. Nevertheless, above 18% of articles are as journal publications which is scientifically significant as it indicates the selected studies are mostly published in forums with high reputation.

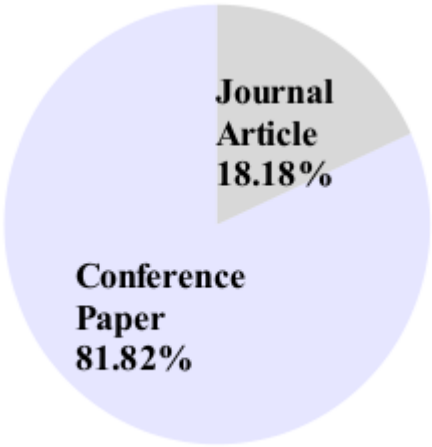

Figure 4: The Ratio of Publications Type

3.3.4 Distribution of Selected Studies from each Source

In figure 5 the distribution of selected studies regarding their source is illustrated. The significant portion of articles, three-quarter, are acquired through exploring ACM Digital Library. With a sharp decrease in sharing percentage, about 18% of papers are provided by the ScienceDirect search engine. The remaining 9% articles are obtained through Scopus Indexing Service.

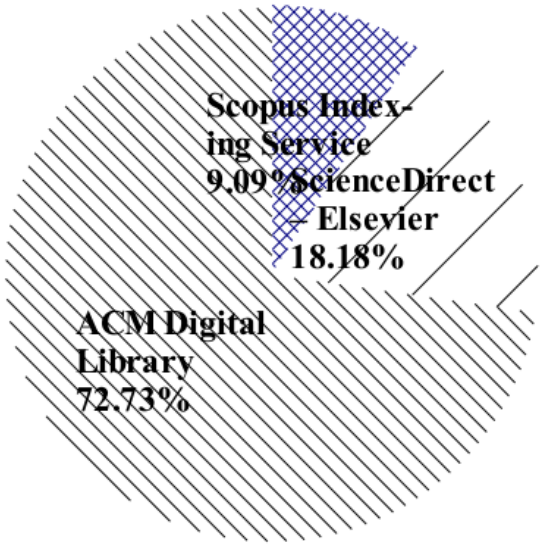

Figure 5: Distribution of Selected Studies from each Source

3.3.5 Distribution of Articles Per Country

The selected studies are published from seven countries which are shown in Figure 6. The United Kingdom and Norway, each one by publishing three articles, have the highest share. A similar number of articles are published in all other countries mentioned in chart namely Canada, Netherlands, Finland, Germany, and Australia, by one article for each country.

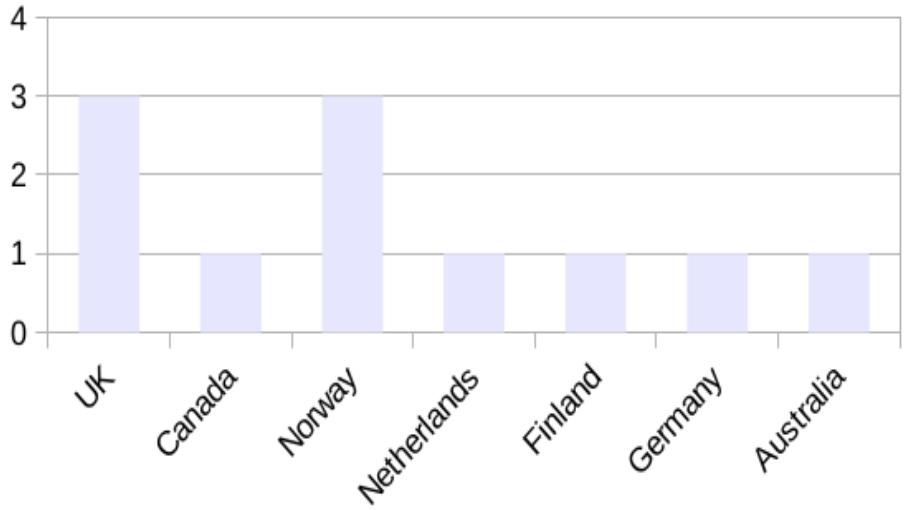

Figure 6: Distribution of Articles Per Country

3.4 Future Studies

Marcus and Mao [41] suggested that "to evaluate the effectiveness of various participation strategies" it is a valuable practice to study participatory design in different context. Regarding this suggestion, we think further research is needed to highlight the potential of this socio-technical collaboration space in the context of large-scale software design.

We also realized that only a few pieces of research had been conducted based on the real-world problem, others are initiated by researchers. We suggest performing more real-case investigations for utilizing social media in the design process.

Further research can be conducted regarding human aspects of software system design and their social and cultural consequences. The design is a social phenomenon [29] which contains cultural aspects of people's everyday life [37]. Studies support this fact that in addition to social media, living lab and crowdsourcing are two other techniques that can be employed for involving potential users in different phases of software design. Characteristics of these two methods can construct a suitable user-centered ecosystem for gaining collective wisdom, capturing user's experiences, and understanding user's needs in real-world configuration.

We think it is a valuable practice to integrate social media, living lab and crowdsourcing techniques within a single tool to form a living collaborative environment in a large scale that facilitates the process of capturing, understanding and modeling users(designers) experiences. Furthermore, human and social factors of software systems design can be investigated using this tool. In next chapter, we present UXModeler project as an initial step toward this goal.

4 UXMODELER: A PLATFORM FOR UNDERSTANDING AND MODELING USER EXPERIENCE

In previous chapters, we reported our results of conducting an SMS study by which we explored the role of social media and their effects on supporting user participation in the design process. These effects have been introduced as advantages that empower the design iterations and lead to deliver better quality design.

In this chapter, we aim to report how we incorporate our findings to extend the capabilities of a social media-based tool, called UXModeler. Our goal is to develop an integrated web-based tool for understanding and modeling user experiences. We employ participatory design concepts in a social media-based environment and aim to find out how applying elicited suggestions and recommendations can result in better usability of software and make better feelings in users.

Furthermore, we introduce Living Labs and Crowdsourcing as two other techniques that can be used for focusing on human factors in software design. We believe that integrating the concepts of social media, living labs, and crowdsourcing into a single platform can facilitate understanding human aspects of software design.

First, we start by presenting a brief introduction to the concept of user experience and usability in software engineering context.

4.1.1 User Experience

In software engineering, the umbrella term User eXperience(UX) refers to all various aspects of the interaction between a user and a software product which may also contain a service or a system tool. User eXperience is about user feelings before, while and after using a product. Feelings and experiences are outcomes of using technology [42] and this can clarify why adapting technology to human nature is a fundamental concern of Human-Computer Interaction(HCI) [42]. There are lots of valid definitions for the term User eXperience because user experiences vary from context to context.

According to ISO 9241-210, user experience includes all the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors and accomplishments during their interactions [43]. The aspects of such an interaction also include the user expectations and evaluating feeling [42]. The interaction could be considered as physical or psychological behaviors or responses from the end-users, even before using a product or service. It means that users' current experiences or expectations may affect the way they will gain their new experience. Similarly, present experiences may turn to new experiences or change previous user's expectations [44].

In general, User eXperience is about how users feel about their interactions with the system emotionally. It also determines to what extent the undergoing tasks are meaningful and valuable in their mind. Studies show that user participation can be used to improve user satisfaction [45]. The sum of several layers and components influence User eXperience in a way that they feel a sense of accomplishment and satisfaction. These layers include User Interview, eXperience and Journey Mapping, Visual Design, Interaction Design, Information Architecture, Content Strategy and User Testing.

Making a successful User eXperience means answering these three questions precisely:

1. Who are real users?
2. What makes them engaged in the interaction with the system?
3. What are their ultimate goals they are hoping to accomplish during these interactions?

Answering the last question is the purpose of usability.

4.1.2 Usability

One quality consequence of participatory design is usability. Peter Morville [46] represents the User Experience Honeycomb (see figure 7) which illustrates a new diagram to show the quality aspects of user experience.

Figure 7: User Experience Honeycomb [46]

Although usability is not the whole of the user experience, however, it provides a significant contribution to it.

Usability refers to the ease of use of a software system or product. The ease with which a user interacts with a user interface influences how people experience the software system. It measures the accomplishment of a task and focuses on answering the question: ***Can the user accomplish their goals in an easy and intuitive way?***

The definition of usability according to the ISO 9241 standard is: "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use."

This definition can be expanded to include five characteristics of a software product: Effective, Efficient, Engaging, Error Tolerant and Easy to Use [47].

Nielsen Norman Group defines [48] usability as: "a quality attribute that assesses how easy user interfaces are to use." Usability also concerns methods that help the "ease-of-use." Their definition of usability contains five quality factors:

1. "**Learnability**": How simple users can learn to perform a primary task at the first visit?
2. "**Efficiency**": How long it lasts for users to do it?

3. "**Memorability**": if users come back to design after a "non-using" gap, how easy they establish the same level of expertise?
4. "**Errors**": The number of mistakes caused by users, How much they are serious? How is the recovery process?
5. "**Satisfaction"**: what is the level of enjoyment that users are experiencing.

Jordan [49] presented a hierarchical model of user's requirements based on Maslow's hierarchy of needs. It has three layers: "*Functionality*" at the bottom, "*Usability*" in the middle and "*Pleasure*" in the top of all other layers. Jordan argues functionality is no longer enough for persuading people to use a product. *Usability* and *Pleasure* increasingly determine the success of a product, and each plays an important role during the decision-making process.

Usability can be considered as a necessary condition for software survival which means that if the software system is hard to use, people leave and stop using it.

4.2 Motivation

Users themselves are a great source of ideas. They can collaborate with each other in the context of a distributed creation engine by which the products will find their ways into the market.

Alcántara et al. in their study of social media environments as collaboration tools for design showed that design activities and collaboration can be categorized in five conceptual groups [29]:

1. Creating ideas and concepts
2. Developing thoughts and meaning
3. Making sense of the material, resources, and experiential knowledge
4. Keeping the team on track
5. Managing the development of the project

There are practices and recommendations that suggest social media can form a powerful environment for achieving the goals of last two categories of these conceptual model [29], [33]–[36].

The development of UXModeler as a social media-based tool has multiple motivations. First, to provide an environment for facilitating and supporting online collaboration functionalities. Alcántara et al. [29] presented some of these functionalities:

1. Group discussion
2. Instant messaging
3. Online forums
4. Social networking
5. Online editing of documents
6. Collaboration between designers, users and other stakeholders
7. Scheduling
8. Tracking changes (Version control)
9. Project Managing
10. Commenting, Voting, and Rating,

Second, a social media-based tool is the best convenient option for gathering user's opinions, capturing user's ideas, understanding user's experiences and creating simple models of it. Utilizing social media as a collaboration environment root in low development cost, ease of use and ease of learning. Nearly four in five Internet users enjoy social networks [50].

Using an online social environment, software engineers can benefit from distributed asynchronous interactions. It also helps them to build valuable remote collaborations across the world. There are significant benefits in such a collaboration.

One advantage is that on-line communities can break the barriers of time, space that limit off-line interactions [13]. These sorts of frameworks increasingly allow a larger number of citizens to take part in developing a software system and participate in a collaborative process [14], [15]. Systematic collecting of user's feedback is another benefit of on-line community frameworks [13].

Gathering hundreds of thousands of user in an online community may be possible in some ways, however, persuading them to play an active and efficient role is not easy. Motivation,

technical difficulties, interacting with others, and finding compelling activities are among user's participation challenges [51].

4.3 The base idea

Our contemporary lifestyle is affected by the intensive dependencies to information and communication technologies (ICTs). Expanding the border of these modern technologies needs a variety of human practices and social innovations [52].

The human-technology interaction and the human experience in different technologies are tightly paired with the context of information in anytime and anywhere. It requires constant investigation which traditional methods of capturing user experience are not able to accomplish. This limitation makes some difficulties for the researchers to understand and model the actions and experience of users in real-world contexts [53].

The idea of **UXModeler**, initially introduced by Seffah et al. [21]. It aims to revolutionize the role of users in the age of social media and easy knowledge access in order to understand user experiences. UXModeler is a platform which provides a meaningful way for capturing, modeling and evaluating user experiences and stories while they are interacting with the software system during different stages of development, testing and use life cycle.

In this thesis, we try to integrate the power of *Social Media* with *Crowdsourcing,* and *Open Living Labs* to construct a robust platform for connecting a vast and wide community of users in which they are able to actively collaborate on performing different tasks of designing and developing a software system.

UXModeler can be used effectively to understand what various clusters of people experience during interacting with a software system. It also facilitates qualitative and quantitative research study of different aspects of user experiences regarding feelings, perceptions, motivations, and learning. It is also a useful tool for describing and capturing user’s need.

UXModeler helps us to capture the software developer's and designer's experiences as well. These experiences include all quality attributes of their interaction with various software development or software design tools. It also ables to arrange an Internet-based (remote) testing environment for performing usability tests [55].

4.4 Exploring the Building Blocks of UXModeler

In previous chapters we explored the power of social media for creating an online collaboration tool. Here we describe how living labs and crowdsourcing can be used to empower the human factor of software design and development.

4.4.1 Living Lab

Software users can be involved either by actively working on an engineering activity or by influencing a management or decision about the software. One of the best contexts to involve potential users and meet the socialness of software is Living Lab.

Based on the definition presented by The European Network of Living Labs(ENoLL) [56] "A Living Lab is an open innovation environment in real-life settings in which user-driven innovation is the co-creation process for new services, products, and societal infrastructures. Living Labs encompass societal and technological dimensions simultaneously in a business-citizens government-academia partnership."

Users are a valuable source of innovation, and there is a good deal of empirical evidence of their innovation in practice [57]. In the term of innovation, the most important characteristics of a Living Lab are namely: Empowerment of Users, Openness, and Realism [58].

User engagement and motivation is a key factor to keep innovation process in the desired path and to satisfy the users' needs. User encouragement is one of the main driving force of users' innovation which persuades end-users to develop, share and distribute their innovative ideas willingly [59] [60].

Openness is related to open innovation [61], crowdsourcing [62] and also is in close relation with lead-users' involvement [63]. Lastly, Realism implies the real-world configuration of such a user-centered ecosystem [64]. Living Labs can be one of the best contexts to involve potential users in different phases of software design and innovation.

4.4.2 Crowdsourcing

Crowdsourcing is the act of asking many people with a different background to participate in a group work and complete a specific task during an unsynchronized and distant collaborative process [65]. Usually, the process of asking happens through an open call on the Internet [65] and collaboration is voluntary [66].

Since the Internet facilitates an easy way for participation, it has become a suitable way for everyone to accept this contribution from anywhere in the world [67]. Contributors explore the problem quickly through a divide-and-conquer way while providing various content and work [68].

Research shows that innovation no longer takes place within a single organization, but rather is distributed across multiple stakeholders in a value network [69]. Online social networking media and user innovation approaches like crowdsourcing can act as innovation tools, not only for understanding user's experiments and capturing their feedbacks but also for engaging them to act as creative innovators.

The potential knowledge, motivation, and experiences of individual contributors, which is previously unavailable and unknown, bring several advantages to Crowdsourcing [69]. The main advantage of crowdsourcing is to create new ideas and innovations. In this term, it is related to the concept of open innovation [70].

Crowdsourcing makes the process of gaining collective wisdom and users' innovative ideas feasible [70]. Users usually have strong motivation to solve needs unmet by existing products. Interestingly, during a study Poetz and Schreier argue that most often, ideas presented by users are new and profitable to them. Their findings suggest that, at least under certain conditions, crowdsourcing might constitute a promising method to gather user ideas [71].

We believe that crowdsourcing can be a key tool in addressing human factor in software systems.

4.5 Architecture and a few Technical Considerations

Seffah et al. [11] suggest the proposed architecture of UXModeler as shown in figure 8:

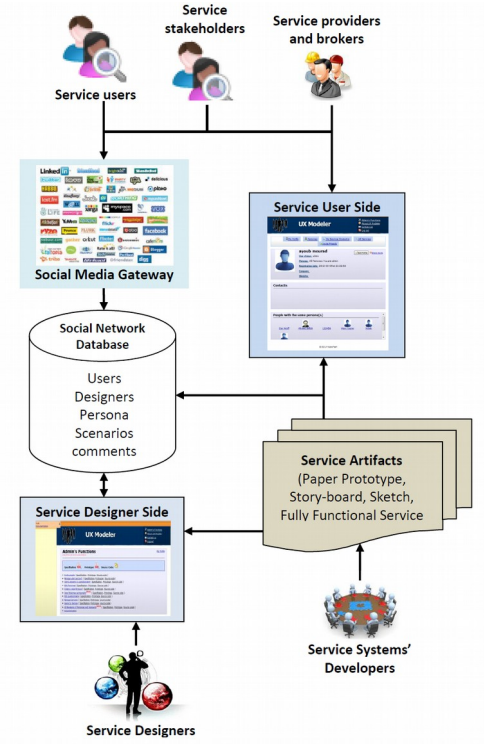

Figure 8: The UXModeler Architecture[11]

This technological architecture uses word *service* to refer to any software system that is being developed alongside with its all design artifacts which will be produced during its user experience design process.

According to Seffah et al. [11] architecture of UXModeler implies three key elements:

1. The Social Network Database (SND) which is a central repository for storing all information including data about users, their profiles and list of friends as well as a description of the various personas, the related scenarios/user stories and comments detailing the user experiences.

2. The Social Media Gateway (SMG) which is a communication bus to connect existing social networks to UXModeler, especially GitHub, Linkedin and Facebook

3. The Service User Side (SUS) interface, end-users as well as designers and developers can create personal accounts, display and manage their profiles, join a service designer and user community as well as add and edit stories and comments on the services they use or develop.

Hess at al. [9] realized that standard web technologies could not completely cover online user participations. They suggest considering better approaches for "linking discussion and design space," "using feedback tools," and "continuous reflection of the current state of development." It means that effective channels for communications should be constructed.

Gopsill et al. [28] discussed that to construct an appropriate tool or process for supporting engineering design communications (EDC) it is important to consider twenty requirements. Table 6 describes the list of these requirements. Our social media shapes and structures the communication flows and discussions about each design artifacts based on these requirements which are listed bellow.

Table 6: List Of Elicited Requirements For Supporting EDC [28]

#	*Description of Requirement*
1	To capture a high quality representation of the originating artifact relating to the communication
2	To record changes to the artifact as a consequence of the communication
3	To enable contributing engineers to embed a representation of an artifact in their responses
4	To provide a text based description of the artifact
5	To record/capture the foci of a communication with respect to the artifact
6	To provide an electronic or physical reference to the artefact
7	To enable engineers to 'push' communications to one another
8	To enable engineers to group communications by task
9	To enable engineers to solicit responses from core competency (expert) groups
10	To enable engineers to assign personal bookmarks to communications
11	To define the purpose of the communication
12	To define the type of response for each contribution to the communication
13	To align the response types to the appropriate purposes
14	To ensure an appropriate limit is imposed on the size of a response
15	To enable multiple-threads within a single communication episode

#	*Description of Requirement*
16	To enable engineers to respond to one or more threads within a communication using a single response
17	To formally conclude a communication
18	To enable engineers to reference responses in past communications within current communications
19	To enable engineers to comment on past communications
20	To classify communications by the Company, Product and phase of the Product Lifecycle

There are some technical approaches that can facilitate constructing a social media-based environment for engaging users in the participatory design process. Strategies include but not limited to:

- Designing multi-platform, multi-devices applications
- Applying Responsive Web Design(RWD) techniques
- Developing Progressive Web Application (PWA)

The development studies of UXModeler will also consider user engagement methods to manage the challenges of large participations through a social media-based tool. Some of these technical issues are:

- Modern approaches for developing a social-media based tool such as Multi-platform, Multi-Devices applications, RWD and PWA.
- Service Oriented Architecture(SOA) and its principals including:
  - *Oauth2* for implementing social login and importing user's data from other social channels
  - *Github* as a platform for sharing produced artifacts and keep a history of all changes
  - *Amazon S3 cloud storage* or *Google Cloud storage* (for implementing artifacts repository)
  - *Pusher* as a real-time push notification service for enabling real-time communication
  - *Google Map*

- The graph is the core concept for Data Modeling in UXModeler. It takes care of nodes and relationship between them as the fundamental units of graph databases. In comparison, with traditional data modeling, using graph data modeling brings competitive advantage regarding simplicity, flexibility, expressiveness, agility and performance.

5 SUMMARY

We conducted a systematic mapping study to understand the influences of the social media-based tools on participatory design. Developing an appropriate protocol supported our research and enabled us to extract the most relevant papers that have been published in academic forums during last five years.

Our protocol includes three main steps: planning, conducting and reporting. After finalizing our plan, we started with electronic searches in five scientific databases that yielded in 365 papers. Then we performed two rounds of deeper review for evaluating the relevance and applying exclusion criteria. Our analysis resulted in 11 articles as our final set.

In exploring user participation through social media concepts and technologies, the suitability of social media as a supporting platform, its capabilities, possible challenges and potential ways of tackling these problems has been presented.

After eliciting reported practices of employing social media technologies into the design process, we incorporated our practical findings into a social media-based tool, called UXModeler which engages users in design activities during different iterations of the process. UXModeler aims to capture and model users experiences which have been shared within online communities by users themselves. To benefit from the power of collective intelligence and real-world settings on a larger scale, we explored crowdsourcing and living labs characteristics as two potential approaches for involving users in the design process.

Our results show that how everyday practices of social media technologies offered designers to benefit from the collective wisdom of heterogeneous people that are distributed all over the world. Focusing on human and cultural aspects of users' everyday life help designers to keep participants motivated and engaged during all contribution stages.

Our study argues that there are positive and empowering aspects of using the social media-based tools. However, our result highlighted that to deliver successful designs and provide users with enjoyable and smooth experiences during use; it is important to seriously focus on human aspect and cultural dimensions of their life.

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APPENDIX 1. INCLUDED PAPERS

Table 7: Included Studies During Selection Process

ID	*Database*	*Title*	*Year*
1	**ACM Digital Library**	**"TweetSpiration: Leveraging Social Media for Design Inspiration" [33]**	**2011**
	Abstract:	*"We present TweetSpiration, a Web-based application that leverages social media to inspire new search directions on the Web. TweetSpiration can be used at any time, but it is particularly beneficial when designers have difficulty developing new search terms or are looking for new search directions. By visualizing socially derived word associations, designers may develop new search directions based on others comments or thoughts on the search topic. In an initial study, users reported that TweetSpiration helps develop new search directions and provides new perspectives on the design problem" [33]*	
2	**ACM Digital Library**	**"UDesignIt: Towards Social Media for Community-driven Design" [35]**	**2012**
	Abstract:	*"Online social networks are now common place in day-to-day lives. They are also increasingly used to drive social action initiatives, either led by government or communities themselves (e.g., SeeClickFix, LoveLewisham.org, mumsnet). However, such initiatives are mainly used for crowdsourcing community views or coordinating activities. With the changing global economic and political landscape, there is an ever pressing need to engage citizens on a large-scale, not only in consultations about systems that affect them, but also involve them directly in the design of these very systems. In this paper we present the UDesignIt platform that combines social media technologies with software engineering concepts to empower communities to discuss and extract high-level design features. It combines natural language processing, feature modeling and visual overlays in the form of "image clouds" to enable communities and software engineers alike to unlock the knowledge contained in the unstructured and unfiltered content of social media where people discuss social problems and their solutions. By automatically extracting key themes and presenting them in a structured and organized manner in near real-time, the approach drives a shift towards large-scale engagement of community stakeholders for system design." [35]*	

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APPENDIX 1. (continues)

3	**ACM Digital Library**	**"Social Media, Design and Civic Engagement by Youth: A Cultural View"** [37]	**2012**
	Abstract:	*"This argumentative essay at the intersection of media studies, Cultural Studies, and literacy research, frames of PD in the emerging territory of social media and civic engagement. We refer to core principles of PD and to recent reflections on social technologies and participation in design. These are linked to research on designing for participative cultural expression via social media. PD is particularly suited to young people's involvement in the context of design and civic engagement. We argue that a cultural view that highlights issues of power, identity, agency, and culture offers useful avenues for negotiating the interests and perspectives of different stakeholders in civic initiatives. There is a need for design to connect to existing participatory and cultures of youth. We offer illustrations of these and a number of considerations for possible future use." [37]*	
4	**ACM Digital Library**	**"Social Media As a Platform for Participatory Design" [39]**	**2012**
	Abstract:	*"In this paper we explore social media as a new arena for participation. The explorations are informed by an ethnographic oriented PD project that follows a PD method and its process of translation within a digital setting. This process is exemplified through outcomes from a Future Workshop that unfolds on Facebook with a group of participants who feed into a new design of a digital photo-archive on mobile phones. With an explicit focus on translation and use of this PD method the paper presents experiences and challenges encountered during the process in this emerging PD environment. Within this, the paper looks at facilitation of distributed users, heterogeneity of users, and fluidity of participation. In subjecting the experiences and challenges to related works the paper sheds light upon matters that can serve as resources for future translations of PD methods." [39]*	
5	**ACM Digital Library**	**"Lessons for Participatory Designers of Social Media: Long-term User Involvement Strategies in Industry" [30]**	**2012**
	Abstract:	*"Social media changes the conditions for user participation in service development. Active user communities, fast paced iterative development, considerable development after market launch, developer access to users' digital trails, peer production, and low cost feature distribution are well known facets that bring substantial changes. In his paper we distil lessons for participatory designers from an in-depth case study of an over decade-long service development in industry, Habbo Hotel by Sulake Corporation. We argue that the range of core issues that shape user participation in social media can be captured by three interrelated issues: 1) shifts in developer – user social distance, 2) cumulated user knowledge beyond one project, and 3) user-generated content and user-owned services. We then consider what insight these provide for a design initiative we are involved in: the Finnish national public service broadcasting company 's teacher resource." [30]*	

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APPENDIX 1. (continues)

6	**ScienceDirect – Elsevier**	**"Involving users in the wild—Participatory product development in and with online communities" [9]**	**2013**
	Abstract:	*"In its traditional stance, participatory design (PD) is centred on certain work/application settings and is concerned with the involvement of representative users from these contexts. Nevertheless, current web technologies enable new forms of distributed participation which might allow PD processes to be implemented in a broader and flexible way, but may at the same time raise new issues in relation to participation. In this paper, we report on a Participatory Product Development project, using social technologies, where new issues were raised a large population of heterogeneous and globally distributed users; a range of personal and institutional purposes, and the use of these technologies in a largely untested environment. We will reflect on insights that we gathered by through observation of and participation in a software development process driven and influenced by members of an existing online community. By means of participatory observation, analysis of the use of online tools and through semi- structured interviews we identified issues around different notions of timeliness and of process structures that are related to different roles, responsibilities and levels of experience. Our results indicate that the involvement of heterogeneous users in such a context needs to be handled carefully, for the reasons we set out. The role of user representatives acting for a broader online community can become crucial when managing heterogeneity, formulating acceptable compromises and- perhaps most crucially- dealing with different professional and 'hobbyist' worldviews. Additionally, we found that the use of standard web technologies only partly support online participation processes. PD 'in the wild' needs to be better embedded in use situations and environments (e.g., by linking discussion and design space, using feedback tools, continuous reflection of the current state of development) rather than refining participatory design as a meta-process separate from use."* [9]	
7	**Scopus indexing system**	**"From participatory design to co-creation: Using social media to engage youth" [72]**	**2013**
	Abstract:	*"UNICEF Pacific faced the problem of how to engage and empower Pacific youth more through social media. The proposed solution was to invite Pacific youth to contribute to the design of a climate change game, the 'Pacific Climate Challenge'. Such an approach presents challenges including how to effectively engage co-creators, how co-creators will communicate and contribute, how contributions will be managed in a virtual environment and how decision making will be managed. This paper explores co-creation in a virtual environment using Participatory Design (PD) theory. Our findings highlight the importance of managing communication with a geographically dispersed team, managing development in an unstructured environment, the importance of leadership and access to both knowledge and skills. We identified that in co-creation environments as compared with typical PD environments, the development process can be less structured with no clear management hierarchy, roles evolve and change and standard success criteria may not apply." [72]*	

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APPENDIX 1. (continues)

8	**Scopus indexing system**	**"A Social Media framework to support Engineering Design Communication" [28]**	**2013**
	Abstract:	*"This paper explores the extent to which existing online collaboration tools support the demands encountered during the early stages of the creative design process. Results from a web survey among design communities and the interviews with 9 designers suggest that Facebook is the most used platform to collaborate with other designers. A qualitative analysis of the data collected reveals that existing tools do not properly support the social processes that define the design process. Furthermore, the design process is affected by the huge amount of information and the inability to filter out and connect the different information provided by the collection of tools. We conclude with a discussion of the results and challenges for future collaboration tools." [28]*	
9	**ACM Digital Library**	**"Re-considering Participation in Social Media Designs" [36]**	**2014**
	Abstract:	*"This short paper reports from a museum innovation project using small-scale design experiments with mobile and social technologies to explore the participative museum along the Akerselva River in Oslo. We reflect upon what insights social media requires for design to engage people in participation in public and urban settings. The paper focuses on the micro-level of engagement in these media, and asks how a focus on anguage, semiotic and social practices may represent new possibilities for PD processes, using these media as design tools. It suggests that perspectives from cultural studies can be adapted to stage social media-based participatory design processes to reach communities that are dispersed over time and space." [36]*	
10	***ACM Digital Library***	***"Social Media As Ad Hoc Design Collaboration Tools"** [29]*	***2015***
	Abstract:	*"This paper explores the extent to which existing online collaboration tools support the demands encountered during the early stages of the creative design process. Results from a web survey among design communities and the interviews with9designerssuggest that Facebook is the most used platform to collaborate with other designers. A qualitative analysis of the data collected reveals that existing tools do not properly support the social processes that define the design process. Furthermore, the design process is affected by the huge amount of information and the inability to filter out and connect the different information provided by the collection of tools. We conclude with a discussion of the results and challenges for future collaboration tools." [29]*	

(Continues)

APPENDIX 1. (continues)

11	**ACM Digital Library**	**"Social Media Resources for Participative Design Research" [34]**	**2016**
	Abstract:	*"We present our experiences of novel value from online social media for Participative Design (PD) research. We describe how particular social media (e.g. Facebook, Pinterest, WhatsApp and Twitter) were used during a five-year project on learning space design by the researcher and interested teachers across all research phases (contextual review, user studies, PD action research). Social media were used to source and share comments, photographs and video documentation, supporting participation in design research. Based on our experiences, we provide recommendations on informed worthwhile use of social media to enrich PD research by increasing diversity, recursivity and timely access to insights, informants, inspirations and influencers." [34]*	

APPENDIX 2. EXCLUDED PAPERS

Table 8: Excluded Studies During Selection Process

ID	Year	Title	Database	Reason
1	2011	Super Dots: Making Social Media Tangible for Senior Citizens	ACM Digital Library	Irrelevant
2	2011	Conversation-based support for requirement definition by a Personal Design Assistant	IEEE Xplore	Irrelevant
3	2011	Cultural aspects in groupware application as an intercultural collaboration technology	IEEE Xplore	Irrelevant
4	2011	WeSketch: A 3D Real Time Collaborative Virtual Environment that Improves the GUI Sketching Task	IEEE Xplore	Irrelevant
5	2012	Social Media As a Platform for Participatory Design	ACM Digital Library	Irrelevant
6	2012	Photographic Social Media: A Framework for Design	ACM Digital Library	Irrelevant
7	2012	Deriving Group Profiles from Social Media to Facilitate the Design of Simulated Environments for Learning	ACM Digital Library	Irrelevant
8	2012	Designing Locative and Social Media Technologies for Community Collaboration and Social Benefit: PetSearch	ACM Digital Library	Irrelevant
9	2012	Distributed and Collaborative Requirements Elicitation Based on Social Intelligence	IEEE Xplore	Irrelevant
10	2012	Toward generative design for digital publishing on mobile devices	IEEE Xplore	Irrelevant
11	2012	A Social Content Delivery Network for Scientific Cooperation: Vision, Design, and Architecture	IEEE Xplore	Irrelevant
12	2012	Multidisciplinary collaborative design decisions of user-participation product development process	Scopus Indexing Service	Irrelevant
13	2012	Social media, design and civic engagement by youth: A cultural view	Scopus Indexing Service	Irrelevant
14	2012	Mapping design practices: On risk, hybridity and participation	Scopus Indexing Service	Irrelevant
15	2012	Understanding participation and opportunities for design from an online postcard sending community	Scopus Indexing Service	Irrelevant
16	2012	UDesignIt: Towards social media for community-driven design	Scopus Indexing Service	Irrelevant
17	2012	Invited SIG - Participation and HCI: Why involve people in design?	Scopus Indexing Service	Irrelevant
18	2012	The quality of design participation: Intersubjectivity in design practice	Scopus Indexing Service	Irrelevant
19	2013	Design and Prototyping of a Social Media Observatory	ACM Digital Library	Irrelevant
20	2013	Social Media Infrastructure: Supporting Communication Practices from Behind the Scenes	ACM Digital Library	Irrelevant
21	2013	Using Social Media and Learning Analytics to Understand How Children Engage in Scientific Inquiry	ACM Digital Library	Irrelevant

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22	2013	Lightweight analysis of software design models at the whiteboard	IEEE Xplore	Irrelevant
23	2013	Summarizing Timelines Based on Content and Social Network	IEEE Xplore	Irrelevant
24	2013	GeCoS: A framework for prototyping custom hardware design flows	IEEE Xplore	Irrelevant
25	2013	Information sharing on social media sites	Sciencedirect Elsevier	Irrelevant
26	2013	Building modern online social presence: A review of social presence theory and its instructional design implications for future trends	SpringerLink	Irrelevant
27	2013	Aligning digital and social inclusion: A study of disadvantaged students and computer access	SpringerLink	Irrelevant
28	2013	CyberGIS design considerations for structured participation in collaborative problem solving	Scopus Indexing Service	Irrelevant
29	2013	Placebooks: Participation, community, design, and ubiquitous data aggregation 'in the wild'	Scopus Indexing Service	Irrelevant
30	2013	Configuring participation: On how we involve people in design	Scopus Indexing Service	Irrelevant
31	2013	Exploring personality-targeted UI design in online social participation systems	Scopus Indexing Service	Irrelevant
32	2013	Conceptualizing perceived affordances in social media interaction design	Scopus Indexing Service	Irrelevant
33	2014	How Social Media Design Shapes Society	ACM Digital Library	Irrelevant
34	2014	Rhetorical Functions of Hashtag Forms Across Social Media Applications	ACM Digital Library	Irrelevant
35	2014	Social Media in Disaster Response: How Experience Architects Can Build for Participation by L. Potts, (2013). New York, NY: Routledge	ACM Digital Library	Irrelevant
36	2014	Evaluation tools through user participation techniques: Features, limitations, and new perspectives	IEEE Xplore	Irrelevant
37	2014	Online Social Networks: Threats and Solutions	IEEE Xplore	Irrelevant
38	2014	Domain Specific Case Tool for ICT-Enabled Service Design	IEEE Xplore	Irrelevant
39	2014	Attitudes towards user experience (UX) measurement	Sciencedirect Elsevier	Irrelevant
40	2014	Persuasive software design patterns for social influence	SpringerLink	Irrelevant
41	2014	A comparative study of collaboration-based reputation models for social recommender systems	SpringerLink	Irrelevant
42	2014	Can Online Discussion Participation Predict Group Project Performance? Investigating the Roles of Linguistic Features and Participation Patterns	SpringerLink	Irrelevant
43	2014	Participatory design for the social media needs of emergency public information officers	Scopus Indexing Service	Irrelevant
44	2014	Visual design recommendations for situation awareness in social media	Scopus Indexing Service	Irrelevant

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45	2014	Users' participation to creative design of new solutions for mobility: An exploratory study	Scopus Indexing Service	Irrelevant
46	2014	Users' participation to creative design of new solutions formobility: An exploratory study	Scopus Indexing Service	Irrelevant
47	2015	Designing Tools to Support Advanced Users in New Forms of Social Media Interaction	ACM Digital Library	Irrelevant
48	2015	Harnessing Social Media to Ethno-pedagogy	ACM Digital Library	Irrelevant
49	2015	Mining Memories: Designing a Platform to Support Social Media Based Writing	ACM Digital Library	Irrelevant
50	2015	Using Social Media Sentiment Analysis for Interaction Design Choices: An Exploratory Framework	ACM Digital	Irrelevant
51	2015	The Role of Structural Information for Designing Navigational User Interfaces	ACM Digital Library	Irrelevant
52	2015	DisasterBox: Designing Social Media for Disaster Relief	ACM Digital Library	Irrelevant
53	2015	Towards a Framework for Gamification Design on Crowdsourcing Systems: The G.A.M.E. Approach	IEEE Xplore	Irrelevant
54	2015	Towards a Social and Ubiquitous Web: A Model for Socio-Technical Networks	IEEE Xplore	Irrelevant
55	2015	Collaborative working: Understanding mobile applications requirements	IEEE Xplore	Irrelevant
56	2015	Supporting user interaction of social network mobile application with multimodal interaction	IEEE Xplore	Irrelevant
57	2015	Understanding user participation in online communities: A systematic literature review of empirical studies	Sciencedirect Elsevier	Irrelevant
58	2015	Understanding the role of social context and user factors in video Quality of Experience	Sciencedirect Elsevier	Irrelevant
59	2015	Collaborative competencies in professional social networking: Are students short changed by curriculum in business education?	Sciencedirect Elsevier	Irrelevant
60	2015	Connecting agents: Engagement and motivation in online collaboration	Sciencedirect Elsevier	Irrelevant
61	2015	Youth appropriation of social media for collaborative and facilitated design-based learning	Scopus Indexing Service	Irrelevant
62	2015	Design of individualized eco labels using social media	Scopus Indexing Service	Irrelevant
63	2015	Social media-based learning in the design studio: A comparative study	Scopus Indexing Service	Irrelevant
64	2015	Social media as ad hoc design collaboration tools	Scopus Indexing Service	Repetitive
65	2015	Participation in design between public sector and local communities	Scopus Indexing Service	Irrelevant
66	2015	XHELP: Design of a cross-platform social-media application to support volunteermoderators in disasters	Scopus Indexing Service	Irrelevant

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APPENDIX 2. (continues)

67	2015	Supporting engineering design communication using a custom-built social media tool - PartBook	Scopus Indexing Service	Irrelevant
68	2015	Design for social media engagement: Insights from elderly care assistance	Scopus Indexing Service	Irrelevant
69	2015	Information, participation, and collaboration overload - A design trade-off analysis	Scopus Indexing Service	Irrelevant
70	2016	Mining Interaction Patterns in the Design of Web Applications for Improving User Experience	ACM Digital Library	Irrelevant
71	2016	Using Data from Social Media Websites to Inspire the Design of Assistive Technology	ACM Digital Library	Irrelevant
72	2016	Design for User Autonomy in the System Driven Personalization of Social Media	ACM Digital Library	Irrelevant
73	2016	The motivations, enablers and barriers for voluntary participation in an online crowdsourcing platform	Sciencedirect Elsevier	Irrelevant
74	2016	Understanding participation on video sharing communities: The role of self-construal and community interactivity	Sciencedirect Elsevier	Irrelevant
75	2016	Work or leisure? Designing a user-centered approach for researching activity “in the wild”	SpringerLink	Irrelevant
76	2016	A design science research (DSR) case study: building an evaluation framework for social media enabled collaborative learning environments (SMECLEs)	Scopus Indexing Service	Irrelevant
77	2016	Using data from social media websites to inspire the design of assistive technology	Scopus Indexing Service	Irrelevant
78	2016	The influence of social media on the design of the national image in the globalization context	Scopus Indexing Service	Irrelevant
79	2011	A Case Study on Using Social Media for e-Participation: Design of Initiative Mapper Web Service	ACM Digital Library	Irrelevant