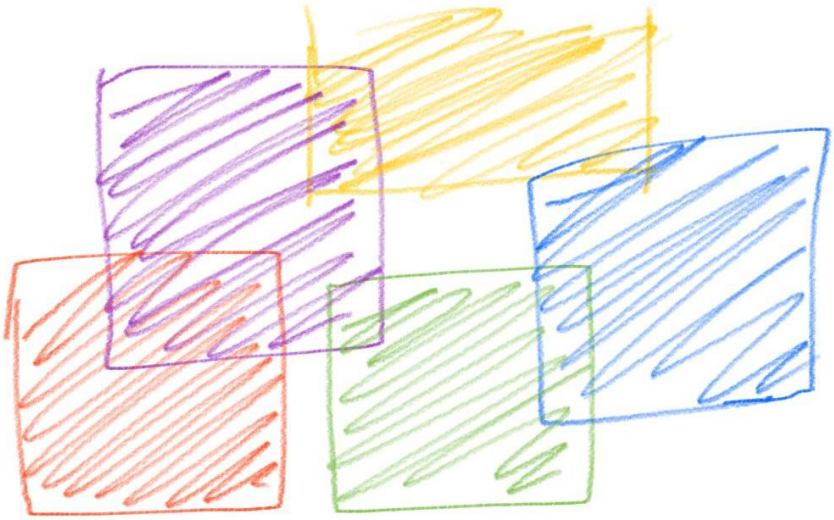
Master thesis

User Requirements Elicitation: A Comparison between Generative Techniques and Semi-Structured Interviews



Alejandro García Navarrete
MSc Communication Science and Technology
University of Twente

User Requirements Elicitation: A Comparison between Generative Techniques and Semi-Structured Interviews

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Master graduation thesis of:

Alejandro García Navarrete
Communication Science
Faculty of Behavioral Management and Social Sciences, University of Twente

Supervisors:

Dr. Joyce Karreman
Dr. Mark Van Vuuren

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Abstract

Background: The human-centered design process involves the user in different design phases to design a quality product. In the early stages of this approach, the end-users are identified and later elicit their requirements. Designers and developers can face challenges when contacting users because they can be unaware of their needs, express emotions, and will probably not have technical knowledge related to the product. To understand human experiences and conscious and unconscious knowledge, designers apply different methods such as semi-structured interviews and generative techniques to help participants express themselves and translate their needs into user requirements.

The human experiences are stored in different layers, from the surface of consciousness to deep unconsciousness. Generative techniques seem to help researchers understand people's unconscious experiences, while the interview method seems to help people understand the surface layers of knowledge. Therefore, it is expected that interviews can only provide a superficial type of user needs.

This research is relevant because it can explain if it is possible to understand people's unconscious needs and experiences by implementing traditional methods such as interviews and newer methods such as generative techniques.

Research question: This research compares the generative techniques and semi-structured interview methods and identifies differences and similarities for user requirement elicitation. This study was conducted online using a video meeting platform and a digital workspace for visual collaboration. Forty students from the University of Twente participated.

Method: The participants were divided into two groups, one for the interviews and the second for the generative techniques, in this case, subdivided into smaller groups. Each method session's goal was to make participants share their thoughts, experiences, and ideal version of the Canvas learning management system.

Results and Conclusions: The results were coded in three different categories, showing more similarities than differences and demonstrating expected results but also presenting unexpected results from interviews as a method of researching requirements

Conclusion: Both methods let participants think and express their past and present experiences and communicate their ideal future technology needs. The interviews can help participants express profound experiences and unconscious knowledge by asking follow-up questions and the generative techniques as expected, helping them express deeper needs and knowledge.

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Finally I want to dedicate this thesis to my dear friend Alejandro "El Abuelo" Ibanez. Later I will tell you all about this experience, while we climb some mountains.

1. Introduction

People use different technology devices and systems to accomplish diverse purposes in their daily life in multiple contexts. For example, a smartphone can be used to take photographs, have video meetings, or check where their e next class is on the university app. This type of device or system's development requires a design process that understands all the stakeholders and end-users context and involves them in this product's development process.

User involvement is defined as the process of including end-users in the design of a product to reach several objectives since they can provide useful information for future product development (Kujala, 2003). The Human-centered design approach considers user involvement in developing innovative solutions based on people's points of view and real requirements to tackle specific problems (IDEO, 2015).

User research helps to identify the end-users and in which context a product or system will be used (Maguire, 2001). This context can be a physical setting such as domestic use, office, or university. The context can also be a digital setting, like a mobile app or a web application on the internet. It is then crucial to research people's experiences, thoughts, and feelings (Norman, 2013) and categorize them into different types of requirements.

For user research, interviews, focus groups, and stakeholder analysis (Maguire, 2001), semi-structured interviews (Courage & Baxter, 2005), and generative techniques (Sleeswijk-Visser et al. , 2005) can be applied. The semi-structured interview is often used in the human-centered design approach to understand and obtain user requirements. This method is characterized by combining a script of questions with the opportunity to ask different items during an interview. A disadvantage is that people may only be aware of expressing ideas and information storage on a conscious level in their mind, and they are continually thinking about it.

A different method is generative techniques. That can be applied to understand what users think, feel, and do (Stappers & Sanders, 2003) in their daily life. It guides participants through different activities, such as a mind map, using multiple types of resources like images, writing on sticky notes, drawings, and any other visual or text element to help them express (Sleeswijk-Visser, 2009). This method offers the advantage of assisting people in thinking profoundly and sharing ideas and information storage at an unconscious level in their minds and communicating it. So, it is a useful method to elicit user needs for designing technology.

When the development team co-creates with users, a product or system can result in some problems. One of these problems is that designers need to balance their professional experience, knowledge, and ideas to create a usable product with the user's experiences, needs, insights, and who do not have the professional background to design a system. Another problem is how the research methods are conducted in current practice to obtain the user's needs and requirements (Steen, 2011).

In case these problems are not considered before starting the design process, the requirements obtained might not be representative for the majority of the users of the product (Steen, 2011) or might be either unrealistic or impossible to develop and thus be rejected in the following phases of the designing process (Aldave et al., 2019).

This study discusses a comparison between applying generative techniques and semi-structured interviews to identify similarities and differences, helping people to think about their past, present, and future experiences to elicit requirements. The aim is to improve user research in the early phases of the human-centered design process suitable for product and software development. Therefore, the following research question will be answered:

To what extent do semi-structured interviews and generative techniques result in different user requirements for designing an interactive software system?

This research uses online platforms and contributes to user requirements research in multiple directions. The study serves as a guide to conduct generative techniques using online tools. Additionally, it contributes to understanding user daily life experiences and how this can be translated into user requirements to design a specific technology, such as a software platform.
In the next four chapters, this study is described in detail. The theoretical framework explains the relevance of user involvement in the early stages of the human-centered design process, a description of both research methods and the experience domain. The method section describes the scenario in which this research was conducted, the resources used to analyze each research method's outcome, and the participant's group. The results section explains the similarities and differences between the generative techniques and the semi-structured interview outcome. The last chapter discusses the conclusions of the research.

2-. Theoretical framework

The Human-centered design (HCD) approach key element is that users are involved in all the phases of developing solutions in multiple fields, such as technology. In the field of software development. Maguire (2001) describes the human-centered design process and how to involve people in all stages. See figure 1.

The first phase defines the human-centered process; the second is to understand and specify the context of use, which the end-users are, and the physical and digital elements required for this technology to operate. The third phase defines the user and organizational requirements; the fourth phase is to produce design solutions. The fifth step is to evaluate the design against the specified requirements. This cycle requires the iterations needed to fulfill the established requirements and goals.

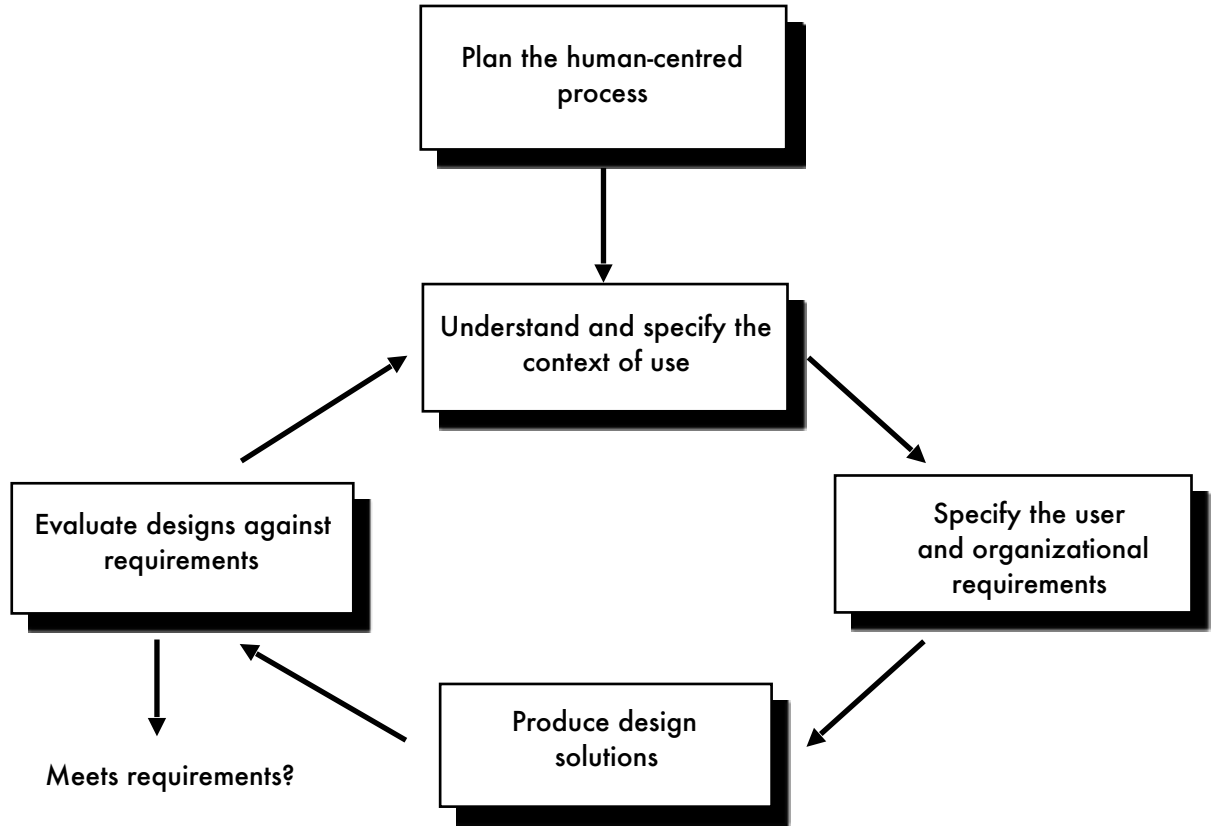

Figure 1 The human-centred design cycle (Maguire, 2001, p.589)

2.1 User involvement

Considering the human participation in HCD is crucial to building effective solutions, the user involvement concept previously researched can be defined as the participation of the future user in the development process of a system or product (Bano, Zowghi, & da Rimini, 2017). It provides multiple benefits to the design process, such as improving the product, avoiding unnecessary or not functional requirements, and improving the level of acceptance of the system or product (Degen, Guillen & Schmidt, 2019). Including the user perspective might be challenging for the designers and developers because their professional backgrounds may make it difficult to think and assume the new user behavior and needs (Wallach & Scholz, 2012). For that reason, they first need to identify the end-users (Gulliksen, Lantz, & Boivie, 1999), and later research with them.

Designers and software developers need insight into the various contexts of using a product (Steppers & Sanders, 2003). They should understand the social practices, cultural environment, and understand people's experiences, including feelings. (Sleeswijk-Visser et al., 2005).

In this context, people's life happens. They have a job or attend school, move to other settings to accomplish their duties and goals. These day-to-day happenings are experiences that can be personal and subjective that only those who live it can understand (Sleeswijk-Visser et al., 2005). When designers involve users, the challenge is to provide them the necessary tools to think about their own experiences, context and express themselves. (Sleeswijk-Visser, 2009).

2.2 User requirement elicitation

Once the target users are identified, the next step of the human-centered design cycle is the user requirements elicitation. This stage aims to understand the needs of the potential users to increase the acceptance of the software a company plans to develop (Maguire, 2001). The software development team needs to establish contact with the target users before starting to design the system.

The interaction between the development team and end-users helps understand what problems users can encounter in a specific environment (Gould & Lewis, 1985), things users need, like, and what elements from the software they find useful. Based on the user's participation, the development team can define, together with other stakeholders, the project goals for the following phases (Batra & Bhatnagar, 2019).

A requirement is what the end-user needs to solve a problem or achieve an objective. The development team must obtain this information to analyze and translate it to design requirements (Macaulay, 1996) for future development steps. Therefore, it is essential to make a clear statement of the different types of needs and share them in the development process to design a useful solution and system (Bevan et al., 2018).

Since the user has an active role and is the basis of the software (Mirri, Roccetti & Salomini, 2018), the research and analysis of his needs represents an essential activity in software development since can define the success of the rest of the development process. (Maguire, 2001). When the software is launched, it should satisfy people's needs and experiences (Sleeswijk-Visser, 2009).

The kind of requirements a user can communicate depends on how conscious or unconscious their needs are. The conscious requirements are those the user is aware they need, defects a product has, or if a new technology offers something better. (Robertson, 2001). The unconscious type of requirements is difficult for users to communicate because they are not aware they need them as they are often fulfilled (Robertson, 2001). For instance, users will not express a login button as a need until they use software that does not include it.

In the software field, the requirements can be categorized into different types. The first type of requirements is called functional requirements: requirements related to what the system does. Besides this requirement, a system has non-functional requirements associated with the system's quality, how good it performs its tasks (Bevan et al., 2018), how it looks at the product, and how fast and safe it is (Robertson & Robertson, 2012).

In addition to these requirements, the undreamed requirements are the users' needs not imagine they can experience using technology or product. It is possible to encourage the users to think about these unimagined requirements once they are aware of the potential a product offers (Robertson, 2001). Therefore, the methods to research user's needs should help understand all of these requirements.

One of the challenges of the user requirements elicitation phase is the difficulties the end-users can encounter when recognizing and expressing what they need and like verbally. Further, it could be the case that users do not have the technical knowledge and request things that are impossible to accomplish and are then useless for the development team and design process. (Aldave et al., 2019).

2.3 Experience domain

The experience domain diagram, see figure 2, represents how humans experience things in their daily life context. Memories represent the past; the moment describes the present, and dreams are the future experiences (Sanders, 2001). For instance, students in the university context have memories from past courses they took or group projects they participated. The moment is the projects they are working on, and they dream with the ideal direction to finish and succeed in their studies for them. This experience domain is a useful resource for designers to understand the user's context and create suitable solutions. (Sanders, 2001).

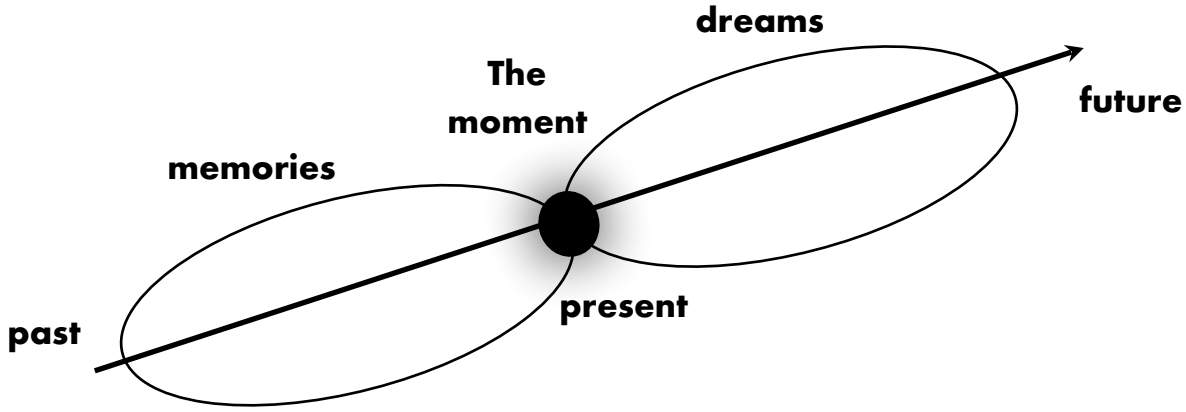

Figure 2 Experience domain diagram (Sanders, 2001, p. 1)

The experience domain can be taken into account when eliciting user requirements. It can help the development team face the challenge of understanding the users by asking them about the past, present experiences, and future expectations regarding software. The past and present experiences can provide functional and non-functional types of requirements. Future experiences (Sanders, 2001) can also help understand the undreamed type of requirements described by Robertson (2001).

Two research methods that can help researchers and designers elicit experiences involving users in the development process are semi-structured interviews and generative techniques. The semi-structured interview is a conversational method often used in The Human-centered approach. Generative techniques are a different method. According to Sleeswijk-Visser (2009), this method can help users think in this future phase, contrary to the semi-structured interviews, where it seems less probable.

According to the research made by Sleeswijk Visser (2009), the knowledge of users is stored in multiple layers, see figure 3. On a surface level is explicit knowledge and is related to what people can say. The next level going deep is observable knowledge and gives information about people's physical context and how people do things. The tacit knowledge and latent knowledge related to what people can dream, feel, and knows are found in deeper layers.

Tacit knowledge, see figure 3, is the kind of information in people's brains: their skills, experience, characteristics, attitudes, motivations, habits, and aspects of culture. They happen unconsciously (Yan and Zhang, 2019; Mejía et al., 2019) and is the knowledge that people acquire by doing (Sandford, Schwartz & Khan, 2020). People's latent needs are nearly invisible and challenging to discover for themselves, but in the end, they are essential. So, in the future, if these needs are satisfied, they can produce surprise and might be enjoyed by people. An example of latent needs regarding technology is the vibration function in mobile phones. Users were not aware of this function, but now it is used by mobile phone users (Sleeswijk-Visser et al., 2005; Raviselvam et al., 2019; Lin & Seepersad, 2007).

Tacit knowledge and latent needs are used to determine the experiences (Sleeswijk-Visser et al., 2005) and include memories and present and future ideas (Sanders, 2001). Therefore, it is difficult for people to express the knowledge with which they act automatically. It is also difficult for them to communicate the requirements in a specific domain (Sleeswijk-Visser et al., 2005).

The scope of this research is to consider these research methods and discuss their main characteristics. In the following two sections, both approaches are described.

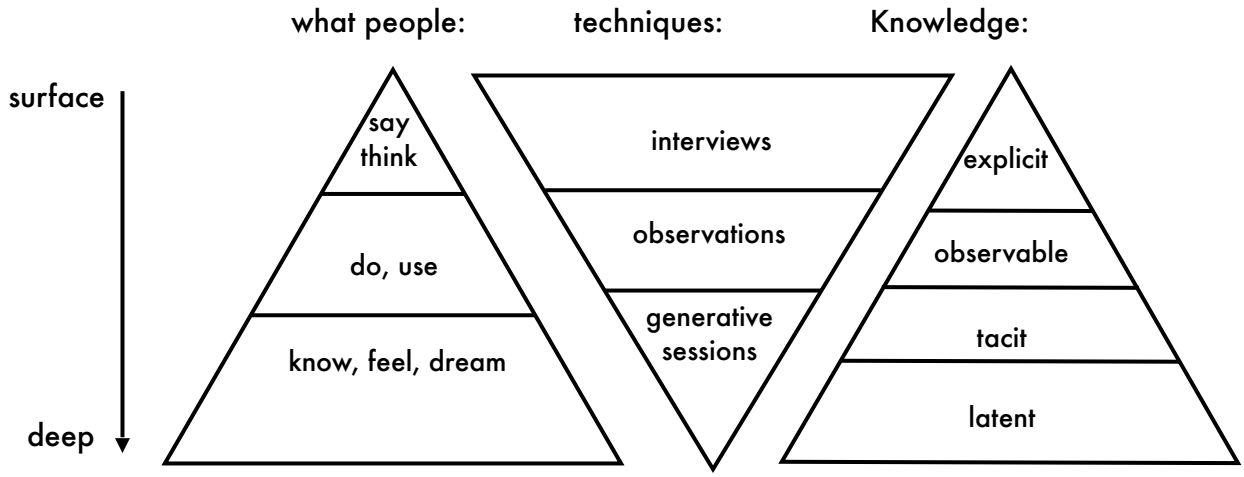

Figure 3 Levels of knowledge and techniques to reach them (Sleeswijk-Visser, 2009, p.17)

2.4 Semi-structured interviews

The interview is a conversation in which one person gathers detailed information from others (Courage & Baxter, 2005). Through this conversation, it is possible to understand people's experiences, feelings, and opinions. It is also possible to learn about past events and social and cultural life (Weiss, 1995). There are three types of one-on-one interviews: the open-ended interview, the structured interview, and a semi-structured interview. These three types share different characteristics (Courage & Baxter, 2005), and which type is used will depend on the interview's goal.

The open-ended interview is characterized by having open-ended questions where the participant is free to respond the way he or she prefers, and the topics do not have an established order Courage & Baxter, 2005). The structured interview is characterized by having a script of questions that include open and closed items that are asked participants in a specific order. (Wilson, 2014).

The semi-structured interview is characterized by having a script of questions and letting the interviewer ask follow-up items during a conversation. So, it is possible to gain insights by digging further into the interviewee's comments (Lazar, Feng & Hochheiser, 2017). This type is used more for an open conversation because it can reveal new issues and experiences about the interview's related topic. It also helps to approach complicated matters through probing or follow-up questions. Lastly, new problems might arise for the interviewer or participants (Wilson, 2014). Therefore, the interview is a recurrent method for the user requirements elicitation phase from the human-centered design.

The semi-structured interview is traditionally used in the user-centered design process to research the user's needs and requirements. It can provide multiple points of view from users concerning a product. (Courage & Baxter, 2005) providing useful information so the development team can continue the design process of a product. Obtaining different perspectives of a product is considered one of the strengths of using this research method.

One disadvantage of the interview as a research method is that it provides information from a surface layer of knowledge. By conducting an interview, the researcher can reach people's memories associated with past and current experiences; unfortunately, it seems it cannot provide much input from participants more profound thoughts, such as dreams and knowledge, see figure 3 (Visser et al., 2005). Also, considering the experience domain, it seems it cannot help people think about a specific topic's future phase or dreams. This future is related to the requirements in dreams or ideal needs the users might have from a software.

Another problem a researcher can encounter using an interview as a research method for requirements is that, during an interview, participants can condition their responses in two ways. One is that participants might not be sincere and explain a specific process or activity as they do it, but instead, how the process should be followed (Courage & Baxter, 2005). The second way is that, during an interview, it is feasible that participants respond according to what they think the interviewer wishes to hear (Courage & Baxter, 2005).

The wording of the questions can be considered a problem since it can affect the participants' responses, influencing their honesty while answering. Therefore, the interviewer needs to keep a neutral posture and have the experience to manage a conversation with the participant (Courage & Baxter, 2005).

As part of the interview as a conversational method, the semi-structured interview seems useful in understanding people's context and opinions. Still, when this method is related to understanding more unconscious information from people, it does not seem helpful.

2.5 Generative techniques

Generative techniques are a research method from the design discipline that combines visual and verbal components in toolkits the people can use to create artifacts, such as mind maps, collages, or stories to express feelings, thoughts, and ideas. (Sanders, 2000). This toolkit's goal depends on the design goal, and the type of information is needed from people. Also, the kind of artifacts desired to create.

The first time designers conducted the generative techniques in the design development process was research involving preschool children. The goal was to obtain needs from them to design a headset that used voice recognition and served as a complement for a software game (Sanders, 2000). In this project, researchers

developed exercises for children who were not verbally skilled. These exercises were drawing, coloring, selecting, and constructing things so the kids can express themselves. (Sanders, 2000).

Generative research inspires and helps designers understand people's experiences and the context in the early stages of product development (Das et al., 2015). Generative tools such as illustrations, sticky notes, images, markers to write, and other sets of significant components are used to obtain tacit information related to unconscious human knowledge and latent needs. These are often unknown for people but useful requirements for users. (Das et al., 2015; Sleeswijk-Visser et al., 2005).

Generative techniques make participants reflect on their concerns, feelings, and joys (Stappers & Sanders, 2003) and guide people in small steps to access this more in-depth user experience such as tacit knowledge and latent needs ultimately to express them. For researchers, they can understand it and use the information for design purposes (Sleeswijk-Visser et al., 2005).

The design team involved in product development must be aware of which factors influence a product. These factors consist of user experience and social and cultural impact (Stappers & Sanders, 2003). Generative techniques allow participants to reflect on their concerns, feelings, and joys (Stappers and Sanders, 2003); develop an awareness of daily life experiences, and communicate them in a visual way (Sleeswijk-Visser, 2009) in a group discussion.

The generative techniques are a flexible method with participants by giving them time to think, express, and reinforce their thoughts through different resources, such as sticky notes, images, and basic shapes. Group discussion inspires other participants to consider new ideas or help to support the expressed ones. So, it seems to be an efficient method to obtain user requirements.

2.6 Expectations for this study

Based on each of the main characteristics of the generative techniques and semi-structured interview methods, the expectations for this study are:

The semi-structured interview method is less useful to reach deep levels of knowledge to understand unconscious knowledge and latent needs from people.

The generative techniques are more useful to reach deeper layers of knowledge. Consequently, make people understand deeper needs and communicate them

With both methods and considering the experience domain, participants can express functional, non-functional, and undreamed types of requirements.

3. Method

This chapter describes the qualitative methods used, a description of the Learning Management System (LMS), the procedure followed by the two groups of participants, and the type of platforms used to conduct the research.

3.1 Learning Management system

This research used a learning management system to compare the semi-structured interviews and generative techniques user research methods. A learning management system (LMS) is a computer program system developed to manage instructional content and assess student's learning performance or an organization (Wat-

son, Lee & Reigeluth 2006). This type of software characterizes by using password-based access, content assignment, and management, enabling communication between students and professors, simple content editing, and tracking student and organization performance (Gouveia & Gouveia, 2006).

The Canvas Learning Management platform offers an open and flexible system capable of adapting to the specific environment that an educational institution has, helping them to face their challenges successfully. This platform was developed in 2009 by the company Infrastructure, and nowadays, is used in seventy countries.

This system comprises multiple characteristics; this platform consists of a Software as a Services (Saas), which means it is an application that has access through the internet. Also, it offers a video feature, a course catalog, offers peer feedback features to build a more collaborative education, the creation of portfolios for the students, and a personalized learning plan. Besides the web application, Canvas is also available for mobile devices.

The University of Twente currently uses Canvas as a learning management system, where each professor can organize the content of their lectures based on their course topic. As an example of how it is used in this university, see figure 4.

3.2 Research design

This study compares two qualitative methods used to understand people's needs and obtain requirements to design technology. One approach is the semi-structured interview and the second method is the generative technique, so each method was considered a different group of participants.

One set of questions were developed and applied to the two research method group of participants. This set of questions were based on the experience domain, so it can be possible to compare how people communicate their past and present experiences and imagine a future scenario. This study was approved by the University of Twente's ethics committee.

The following sections describe how the participants were recruited, how this study was conducted based on each research method's characteristics, and which tools were used to analyze the results.

3.3 Semi-structured interview method

3.3.1 Participants

Twenty participants took part in the semi-structured interviews recruited from the University of Twente using various recruitment methods. One was the test subject pool system SONA platform, which supports research by involving students from the University of Twente and managed by the Faculty of Behavioral Management and Social Sciences (BMS). Another recruitment method was contacting fellow students from the researcher via mail or WhatsApp. From this group of participants, eight participants were from a master's program, nine from bachelors, two from the ATLAS program, and one participant following the Plus -people land and urban systems PhD program. Of the twenty participants, nine were women, and eleven were men.

Of the eight participants studying a master's, two were from the Education science and technology program; one participant was from the Nanotechnology program; two participants were from the Geo-Information and earth observation and natural resource management program. One participant was from Philosophy of science and technology. One participant was from the Communication Science program, as well as from the Human-computer interaction and design. From the group of participants studying a bachelor, four were

from the psychology program, and five were from Communication Science. Appendix A shows the table of the participant's information.

3.3.2 Procedure

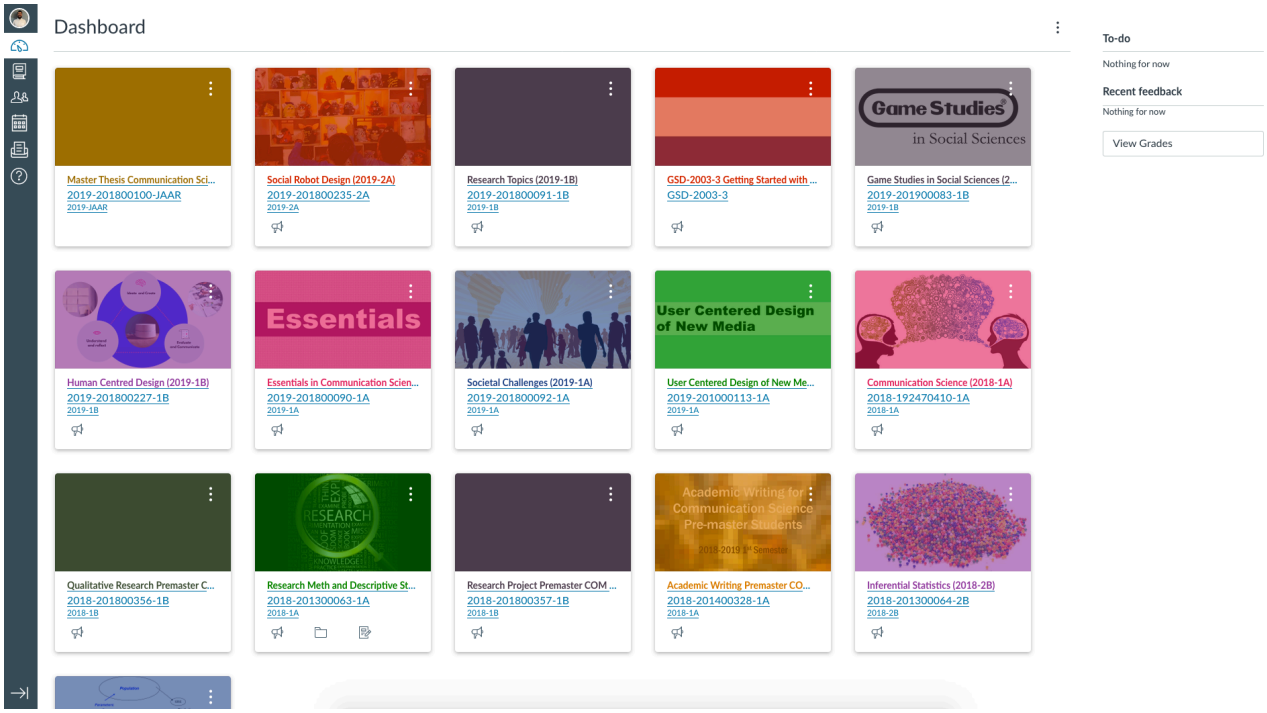

Figure 4 Canvas Dashboard layout. Retrieved from https://canvas.utwente.nl/

The semi-structured interview's goal was to know the student's experience using the Canvas platform, understand what they like, what they do not like, and what the ideal platform could be for them. The interviews were conducted individually using the jitsi.org videoconference tool, and on average, each session lasted thirty minutes.

Before each session, a unique link for the video call was shared with the participant via mail or WhatsApp. The standard procedure was with the camera on, but if participants did not want to activate it or because of practical or technical problems was disabled. In the interviews, the camera was off with only two participants, one for personal reasons and the second for technical issues. In generative techniques, participants turned off their cameras because of technical difficulties in only one session.

The first section of the interview was to know the study background of the participant. The second part was regarding thoughts on the Canvas platform. The third section was regarding the daily use routine using this platform. Lastly, it was to share their ideal version of the platform. For all interview phases, some follow-up questions were prepared to encourage participants to share ideas and opinions. In Appendix B is the complete interview with the follow-up questions per each section.

3.4 Generative techniques method

3.4.1 Participants

Twenty participants participated in the Generative technique sessions and were recruited from the University of Twente using email or WhatsApp platforms. This group of participants was divided into four groups of five members and were assigned to a group session based on their availability to participate in the research.

From this group of participants, fifteen participants were from a master's program. Three were from a bachelor, one from the ATLAS program, and one participant from a PhD program in Education Science. Of the twenty participants, eleven were women, and nine were men. In the appendix, C is the table for the distribution of the participants.

3.4.2 Procedure

The generative techniques session's goal is to know the experience, the daily routine of using the Canvas platform and imagine the future or ideal version of the Canvas platform. Before each session, a link to the jitsi.org video calling platform was shared through email or WhatsApp. Once everyone was online in the Jitsi session, the link to the Mural.co platform was shared on the chat, so participants entered the layout to work on their activities. On average, the sessions lasted ninety minutes.

Jitsi and Mural platforms were selected because participants could access these platforms anonymously and without downloading an app. Also, the Mural platform offered all the resources to create their artifacts in this research. These resources are sticky notes and basic shapes - such as squares, lines, or arrows. Also, participants were able to use icons and images. Figure 5 represents the template used for the generative techniques sessions.

Once the participants were on the Mural link. The researcher explained the platform features and later assigned each participant to a spot in the layout, where they worked on their artifact. Each area was tagged with a number to distinguish the participants.

The generative technique session was composed of four activities. The first activity was a warm-up for participants to introduce themselves to the group and interact with the platform. The second activity was related to thoughts about Canvas. The third activity was to express their daily routine of using the Canvas platform. The fourth activity was to share their ideal version of the Canvas platform based on their academic experience. To see the complete description of the generative technique session, look at Appendix D.

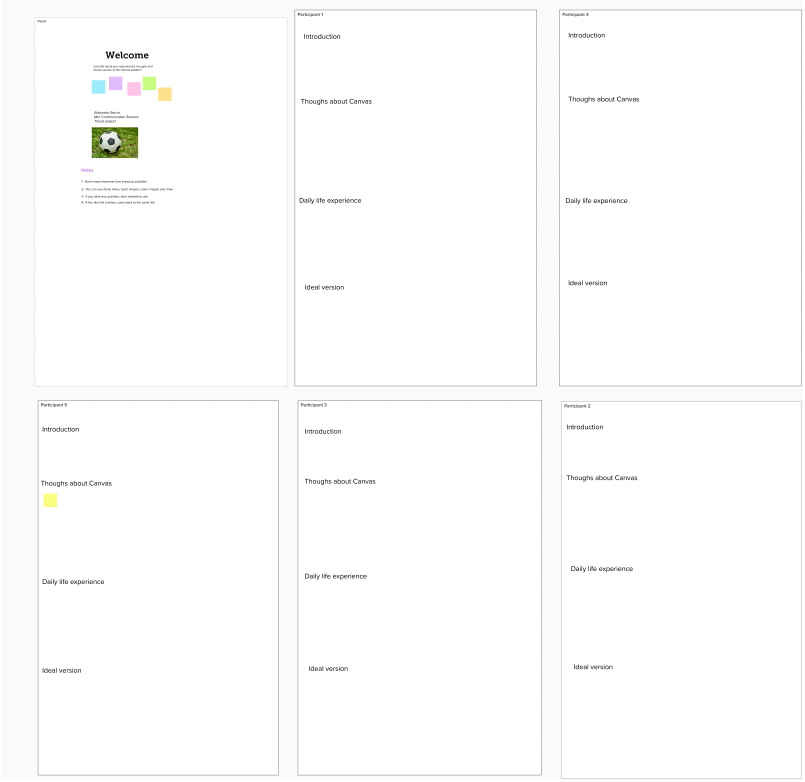

Figure 5. Generative Technique layout used in Mural platform

3.5 Data analysis

The audio from each interview session and generative technique session was recorded and transcribed using Amberscript Software. Later the text was analyzed and codified using Atlas.ti software.

The semi-structured interview data were analyzed first. In the first phase of open coding, the interview transcriptions were analyzed to get the first list of codes. In a second phase, this first list was analyzed, and similar codes were grouped, and three categories were identified and were used to develop the first version of the codebook.

The first version of the codebook was used to analyze and code the data obtained in the generative techniques, and new codes were added. The second version of the codebook included forty-five codes, divided into three categories. See Appendix E.

A second coder analyzed 10% of the fragments assigning the codebook codes; Cohen's kappa value was (0.61). This codebook was also used to analyze the generative techniques transcriptions, and new codes were added. The codebook resulted in 45 codes, divided into three categories. See Appendix E.

4. Results

The result section is divided into four categories. The first category (4.1) describes how participants use the study materials and other contents of Canvas. The second category (4.2) presents how participants interact between them and how the platform communicates with them. The third category (4.3) describes the participant's suggestions on how to improve the Canvas platform.

For each of these three categories, the comparison of both methods is reported as the similarities (4.1.1, 4.2.1. and 4.3.1) and the differences (4.1.2, 4.2.2., 4.3.2) between the interviews and generative techniques. In the fourth and final section (4.4), a comparison is made between the two method's outcomes and characteristics. It includes a reflection on, among other things, the role of the researcher in the process of data collection.

4.1 Use and management of the platform's content

This category refers to the user's experience, accessing, and using the platform's lecture materials for their academic purposes. Table 1 describes the results of this category in both methods. See Appendix F.

4.1.1 Similarities

With regard to the use and management of the platform's content, participants in both methods made similar comments on the following four topics:

1-. How the content is organized
2-. How teachers manage the platform
3-. Retrieving study materials from the platform
4-. Course details information

1-. How the content is organized. Participants expressed similar opinions positively and negatively regarding how the content is arranged in the platform.

The content organization's negative experience is associated with the students' problems finding the course page's study materials.

Participants in the interviews said: "I think the problem is that it is pretty inconsistent and between different courses and teachers. Some of them organize it in a better way."
Participants in the generative techniques said: "So it's like, yeah, you can navigate through the app, but then. It's not the same for each course in each. I need to get used to each course specifically."
The positive experience of how the content is organized is related to how easy it is to find the study materials on the course page.
Participants in the interviews said: "the module with the assignments, I think for the basics. It looks like it is organized in a way that it's easy to work for, but yeah, that's my perception". Participants in the generative sessions said: "I will disagree a bit with participant 3 there, but maybe I was more lucky because I really like how the pages are structured."

2-. How teachers manage the platform. Participants in both methods expressed negative experiences regarding how the teachers, as users of the platform, arrange the course pages' study materials.
Participants in the interview said: "I think it just depends on how organized the teachers like that is if the teacher is really organized they will make it organized. If the teacher doesn't really care, then it is not organized¨. In generative techniques, participants said: "sometimes professors know how to use this. Sometimes they don't. And it's just so inconsistent. And also, sometimes it's very difficult".

3-. Retrieving study materials from the platform. Participants in both methods expressed their experience downloading the different study materials they needed to consult previous lectures or study for exams. Such materials are lecture slides, articles, or video lecture of the classes.
Participants in the interviews said: "from the beginning, download all the documents from canvas for a certain topic and just put in a folder on my computer, so I'm sure that I can also work or access them when I'm in a train, when I do not have Internet or when I don't have access to the Internet." In the generative sessions, participants said: "So my strategy was as soon as I can download everything and also even save the links of the submission links somewhere else just in case."

4-. Course details information. Participants in both methods expressed problems seeing important information such as the location and time of the lectures' calendar feature on the Canvas platform.
Participants in the interviews said: "the calendar does not actually show my lecture times. So my rooster is a separate website. So that's the best information that I need is when my lectures are or when, you know, tutorials or seminars are. So that information doesn't appear on the canvas." In the generative sessions, participants said: "the calendar sometimes it doesn't reflect what I need to do all my day."

4.1.2 Differences

With regard to the use and management of the platform's content, participants expressed different comments on the generative techniques but not on the interviews on the following four topics:

1-. How easy it is to use the platform
2-. When to access the course page
3-. Working with other students
4-. Managing private information

1-. How easy it is to use the platform. Participants in the generative techniques mentioned different experiences defining how intuitive it is the LMS than participants in the interviews.
Participants in the generative sessions said: "the fact that you can find stuff without having received training or some, you know, you just know how to find stuff." Participants did not mention the platform is intuitive.

2-. When to access the course page. Participants in the generative techniques mentioned different experiences accessing the course page to read the information than the interview participants.
Participants in generative techniques said: "I use the Canvas for the course, at the beginning of the new course. So I read through the information. I read through all the information. Usually, I don't catch them afterward. I always look back into the information I need".

3-. *Working with other students.* Participants in the generative techniques expressed positive opinions related to working on group projects and submitting the document. Participants in generative techniques said: "Only one person had to do it. So not everybody had to worry about it. And just one person could say. It was one I didn't complete yet." Participants in the interviews did not express something related to group work submissions.

4-. *Managing private information.* Participants in generative techniques expressed concern about how their contact information is displayed on the canvas platform. Participants said: "A thing that needs to be pointed out that maybe not so nice, Privacy concerns because our names are upload, you can see all names. So in terms of privacy is not a bad thing. That's something to point out*"*. Participants in the interviews did not express concern about privacy issues.

4.2 Interaction between users and the platform

This category is related to the user experience of sending messages, sharing, and receiving information regarding their academic matters with other users. The platform communicates educational information such as deadlines, notifications, and updates to its users. Table 2 describes the results of this category in both methods. See Appendix G.

4.2.1 Similarities

With regard to the interaction between users and the platform, participants in both methods made similar comments on the following two topics:

1-. Using new tools on Canvas.
2-. Teachers communicate announcements with students.

1-. Using new tools on Canvas. Participants expressed similar opinions in a positive form regarding using new tools to have online lectures throughout the Canvas platform.
Participants from the interviews said: "the conferences are always, mostly fine sometimes they are some troubles with connections. Some people sometimes can't get in. Mostly it works". Participants from the generative techniques said: "the conference tool is quite nice, the big blue button. I really like it, and they also have the option to get recorded that they say available there, which I find also find very useful".

2. Teachers communicate announcements with students. Participants expressed similar opinions in a positive form regarding how teachers use announcements to share relevant information, such as notifying when an assignment was graded or a deadline was published.
Participants in the interviews said: "I got an email from Canvas if there is a notification. So it's it's pretty good. I would say. All right. At least our teachers utilize it really well. That's good".
Participants in generative sessions said: "I like the feature of the notifications because you can almost instantly know when an assignment is graded."

4.2.2 Differences

With regard to the interaction between users and the platform, participants made distinct comments between methods on the following three topics:

1-. Notify updates through the Canvas platform
2-. Use the platform as a means of communication
3-. Submitting feedback on student work

1-. Notify updates through the Canvas platform. Participants in the interviews share different opinions regarding the notifications and the announcements to communicate course information than participants in generative techniques who share negative and positive views on this topic.
Participants in the interviews said: "Well, when there are new slides on or deadlines or those things, I think that's handy, you get you get a notification if you want."
Participants in the generative techniques said: "I'm still getting emails from canvas, sometimes with the old, old courses. Not sure how it is possible because I think they are all done." Another participant said: "what participant 1 said. What I didn't really thought during this particular station, the notification are really helpful. Exactly. Oh, yes, my grade is out. So let me check it out."

2. Use the platform as a means of communication. Participants in the interviews mentioned different experiences communicating with other students and professors throughout the platform than participants in the generative techniques who did not note the preference of email use to contact teachers.
Participants in the interviews said: "communicating with teachers through e-mail still looks the most professional way to communicate for me. So I think I will still use e-mail over a canvas option to communicate."

3-. Submitting feedback on student work. Participants in the interviews expressed different opinions regarding the submission of input from the individual or group work presented in the platform than participants in generative techniques.
Participants in the interviews said: "I forgot to mention before about communication. Well, that I really like is how the feedback for the assignments is done because, like, you submit your assignment, and then you have to go to that submission, and then it's it opens like a preview of your document."
Participants from the generative techniques said: "I think I got feedback once, and it was in a group assignments with two persons, of course. And I didn't hand in the thing, but my partner did, and she was the only one who could see the feedback so I could see the feedback until the teacher sent it to me."

4.3 Suggestion to improve the platform

This category is related to future expectations for the platform. Table 3 describes the results for this category in both methods. See Appendix H.

4.3.1 Similarities

With regard to the suggestions to improve the platform, participants in both methods made similar comments on the following two topics:

1-. Create a standard to organize the content
2-. Unite all the university platforms.

1-. Create a standard to organize the content. Participants expressed similar opinions regarding standardizing or creating templates to manage the course page and study materials.
Participants in the interviews said: "what I would improve is that maybe every module has the same structure so that you don't need to adapt to every new module on your version."

Participants from the generative techniques said: "it will be nice for teachers when they have a course on how to not mess up Canvas, because, as we said, it really depends on the teachers, how messy or messy they're making it. So yeah, would be nice if they would have a template and then of course, on how to make it the most usable and intuitive for the students."

2. Unite all the university platforms. Participants expressed similar opinions regarding unifying the different platforms students use for their academic university.
Participants in the interviews said: "We have like Osiris and rooster maybe if it were one like we could maybe through canvas we were able to see our progress. Like, instead of login into Osiris, and then if you like, there's some people who also used rooster."
Participants in the generative techniques sessions said: "I would really like to synchronize canvas and rooster that way we have our calendar every day to know when to do it during the week. I don't know if the UT, but definitely the ITC, we get like a very specific schedule of every lesson."

4.3.2 Differences

With regard to the suggestions to improve the platform, participants made distinct comments between methods on the following three topics:

1-. Add features to solve problems
2-. Use of communication features
3-. Suggestions to improve the group grading system

1-. Add new features to solve problems. Participants in the interviews expressed to add features to tackle specific problems than participants in generative techniques who consider solving issues by improving the platform features than adding new ones

Participants in the interview said: "Maybe something like a tracking progress from the current module you are in now...but I don't know exactly how it should be like."
Participants in generative techniques said: "it's good to see who is the course with your or in the groups with you. But I also think messaging tools could be more intuitive or improved."

2-. Use of communication features. Participants in Generative techniques expressed different opinions regarding the LMS platform's communication features than participants in the interviews who prefer to add a new chat to communicate.
Participants in generative techniques said: "So I think improve the communication channels like it's really hard to send e-mails to the teachers."

Participants in the interviews said: "Like I want to chat with my teacher and say, okay, this is going on even if he sees it later. I think having like the communication being more present. I be like on Facebook where you have like a Chat box's on the bottom. Like, every time you get a message, you get something like that."

3-. Suggestion to improve the group grading system. Participants in generative techniques expressed different recommendations to improve the teamwork grading system than participants in the interviews who did not say suggestions on this issue.

Participants in generative techniques said: “so when you submit a group assignment, you don’t know like the connection between the groups is up there. You don’t know if you submit it for the whole group someone submitted and somewhere else”.

4.4 Similarities and differences based on the characteristics of the methods

4.4.1 Similarities

1-. Participants have insight in their past and current experiences
2-. Participants identify the main elements of the Learning Management System
3-. Participants expresses honest opinions

1-. Participants have insight in their past and current experiences. Participants in both methods understood and told their past experiences of using the LMS. Regarding the present experiences, participants in both methods also understand and expressed the context of using new tools to take online lectures.
Participants in the interviews said: “Well, I use canvas just for access to the courses. Nowadays, we have these online lectures, so you have to go to the conference equally every day and every time you have a conference to follow a lecture. So in this moment, that is the main use and also to get information, data, readings, and all related with the course, the material that you have to follow for the course.”

Participants in generative techniques said: “Well, I was thinking of what are the things I use more when using canvas on a day to day basis. And I thought that the first thing I usually do check my announcements... and also during these times are using the video conference a lot. All my lectures are online, and most of my professors. They use this feature, and sometimes it’s easy to access.”

2-. Participants identify the main elements of the Learning Management System. Participants in both methods identified content management and communication as the main elements of the LMS. In both methods, they identified some problems in the content management element. They suggested the functional requirements to improve in a future version of the LMS, such as creating a standard to organize the study materials.

Participants in the interviews said: “when we have to do more assignments at once, then I think it could be more structured because also the names of their assignments are really. I don’t know, sometimes you don’t get what the connection is to which subject this belongs directly”

Participants in the generative techniques said: “It depends what the teacher's doing with it, because I have some course where everything looks very organized and structured. Everything was clear. And then also other completely had an overload of information within their courses.”

3-. Participants expresses honest opinions. Participants in both methods expressed positive and negative opinions, avoiding thinking the researcher might like to hear only positive statements.

Participants in the interviews said: “I think I am ever really used canvas this communication platform since, now. So since the Coronavirus happened. But for now, I think it’s really nice because you can get in touch with your professors and teachers of tutorials.”
“Sometimes I think it’s a little bit messy because it could be a little bit more organized, especially for the components itself. Separate sections, but I think it could be. Yeah, well organized and structured at least to find it in a more easy way.”

Participants in the generative techniques said: “Yes, I think actually it was my first experience with a platform for my studies. During my bachelor, I didn’t have any. I know sometimes they have. But for me, it was

the first approach to having an online platform to use as a tool for my studies. So in that sense, I think it was good experience."

"Yeah. It can be confusing. Where to find what and where to submit what yeah. But it has different tools levels. I don't know how to call this syllabus, modules."

4.4.2 Differences

1-. Participants in the interviews needed more follow-up questions than participants in the generative sessions
2-. Participants in the interviews expressed less latent needs than participants in the generative sessions
3-. Participants in the interviews expressed more specific, individual requirement for their ideal version of the LMS than participants in the generative techniques

1-. Participants in the interviews needed more follow-up questions than participants in the generative sessions. Participants in the interviews expressed detailed information by answering the follow-up questions regarding their experiences and their future suggestions for the LMS differently from participants in generative techniques who gave detailed information without the researcher's necessity to ask the follow-up questions.

One participant in the interviews said: "So I'll try, well, ok. So I think I already kind of said that I'm. Pretty happy with how Canvas is structure and how it's made and how was organized." Later, when the same participant was asked a follow-up question about his academic performance, he said: "I would maybe say search, search bars are good thing, usually Web sites. If I want to find something very quickly...if I want to submit an assignment, I just maybe go writing the search bar assignment research. And then if I search, it's just going to be there. So I just click on it. I select the files and submit it".

Participants in generative techniques said: "I tried to draw a little sketch of what it would look like and highlight the main things that I think would improve. So like, where the main area for the courses, of course, is I think it should be better customizable and like people mentioned, like the need to put things into folders or even have your own folders synch to, like your own computer folders."

2. Participants in the interviews expressed less latent needs than participants in the generative sessions. Participants in the generative techniques recognized the latent need for private information management by expressing concern that other users can access personal information in the LMS. Participants in the Interviews did not realize this privacy need.

This difference implies that participants in generative sessions can reach a deeper level of knowledge and communicate needs that are often covered in other type of online platforms.

Participants in generative techniques said: "A thing that needs to be pointed out that maybe not so nice, Privacy concerns because our names are upload, You can see all names. So in terms of privacy is not a bad thing. That's something to point out."

3-. Participants in the interviews expressed more specific, individual requirement for their ideal version of the LMS than participants in the generative techniques. Participants suggested to add more functional features than participants in the generative sessions as a future expectation of the platform. This additions represent individual preferences for specific functional features of the Canvas platform. The suggested additions made by participants in the interviews are listed in Table 4. See Appendix I.

This difference implies that participants in the interviews were more oriented to suggest functional requirements that solve the future version's individual needs than participants in the generative techniques.

Participants in the interviews suggested: "I would like, for example, downloading information would be nice to do batch downloads. I don't know. That's the thing right now[...]. One day we saw like five presentations straight. If I could just click them, click, call the five and download them, all of it at one. They'll be super helpful "s

Participants in the generative techniques said: "Yes. I think for me as an I agree with a lot of the points that participant 1 already said. For me personally, I think that most of the features that I would like and more already are there. I think the thing that is lacking, is the proper integration with other tools."

5. Discussion

This section presents the main findings from the results, the theoretical implications, limitations, and suggestions of this research.

5.1 Main findings

An observation in the results is that participants gave the impression to be honest with their answers, expressing positive and negative experiences with Canvas and the teachers who manage the content, avoiding just mentioning positive opinions and thinking this is what the researcher wanted to hear.

This research shows that both methods helped participants think and express their past and present experiences, divided into positive or negative. Also, it assisted the participants in identifying the different ways they use the Canvas system. Besides, both methods helped participants to express a specific context of usage of the learning platform.

For the semi-structured interview, this research proves to be an efficient method to understand different participant's views about a product. (Courage & Baxter, 2005). These research results also prove that generative techniques of using different tools like sticky notes or images helped participants express their usage of this technology. (Das et al., 2015; Sleeswijk-Visser et al., 2005).

Further, this research proves that it is possible with both methods to elicit tacit knowledge from participants. It was possible to identify the skills, attitudes, and habits (Yan and Zhang, 2019; Mejía et al., 2019) of using a specific technology. Tacit information is located at a deeper level of people's knowledge. Still, it is different from latent needs, which are deeper because it is more difficult for people to recognize them, more invisible (Sleep-Visser, 2005) can be seen in figure 3.

Participants of the interviews could not reach a deeper level of knowledge because they did not have the time to think and the resources, such as the images or the sticky notes to support in communicating their thoughts.

For instance, participants in the interviews identified confusion and frustration in finding the study materials. They also expressed the habit of consulting the course page and downloading material at the beginning of each course and developed the skill to understand and adapt to how the platform content was organized.

The fact that interviews helped participants to communicate and expressed how they learn to use the platform and understand how other users like the teachers organize the content proves that people can reach tacit knowledge level and communicate it through an interview

This study also shows that both methods seem to be useful for identifying the main features this technology is required to have to fulfill the end-user objectives. Both research methods helped participants to identify their requirements for future development. As an experience, some participants had used a learning management system, encountered specific problems, and compared previous experience to their present experience using the Canvas platform. This fact was expected for generative techniques, as mentioned by Sanders, 2001, and expected from the undreamed type of requirements, but it was unexpected for the interviews.

This study concludes that it is possible to obtain future expectations and tacit needs from people regarding a specific technology since participants in the interviews expressed the tacit need to have a standard organization in the content to avoid spending time learning how each teacher organizes their course materials.

As expected from the semi-structured interview characteristics, the follow-up questions were often used to obtain further information from the participants (Wilson, 2014). This characteristic also represented a relevant difference between the compared research methods. The follow-up questions helped participants express more profound thoughts from past experiences and more information about their current experiences for the semi-structured interviews. On the other hand, for generative techniques, the follow-up questions were not often used, because of the chance that participants had first to think and portray their ideas using the diverse resources on the mural platform, such as the sticky notes, images, and icons.

Regarding the suggestions for future changes for the Canvas system, the semi-structured interviews offered a long list of changes. The majority of these suggestions are technical additions to solve problems participants detected, but it might be challenging to translate them into real solutions. Compared to the generative techniques requests, the changes seem to be more aligned to improve and promote its use of the features the Canvas system provides. It was unexpected for participants in the interviews to share more functional requirements as the undreamed type of needs.

As expected, the generative techniques guided participants to think and share their thoughts about Canvas technology (Stappers & Sanders, 2003) and provided useful information to redesign the platform. (Sleeswijk-Visser et al., 2005). Additionally, it seems to help participants reflect on the latent needs regarding the Canvas platform, such as the privacy issue. It was mentioned in various sessions and discussed how important this topic is to consider or not in the Canvas platform.
In addition, to the privacy concerns, the generative techniques helped participants to think about the communication in the platform and deter the problem is the lack of interaction between the users, not the absence of communication tools.

Finally, the generative techniques participants seemed to have a balanced opinion about positive and negative experiences using some features of the Canvas software, such as the communication features. For this reason, they were more conscious of improving them instead of replacing this type of functionality. The undreamed requirements are suggested to balance new functional features and improve the non-functional features the LMS uses.

5.2 Theoretical implications

This research reinforces the benefits of involving the users in the requirements elicitation phase, as established by Degen, Guillen & Schmidt, 2019. Participants expressed acceptance of using the Canvas system and suggested the needs to improve this platform's quality with both methods.

Contrary to the disadvantages of interviewing people and the possibility to obtain a dishonest answer mentioned by Courage & Baxter (2005), the participants of the semi-structured interviews seemed to respond

with honesty in their thoughts from the Canvas system. This remark is linked with the human-centered approach of involving users to talk about their insights related to a tool used in a specific context, in this case, their academic life. This disadvantage can be arguable when users are asked about an essential tool because they seem interested in exposing and solving specific problems and expressing the features from this tool that provides a positive outcome.

This research adds to the concept of tacit knowledge, as researched by Yan and Zhang, 2019; Mejía et al., 2019 and Sleeswijk-Visser, 2009. The semi-structured interviews guided participants to reach this layer of knowledge by asking follow-up questions. This conversational method is considered only to obtain a surface level of information, see figure 3. Because participants expressed their motivation to use the platform's features, skills to learn how to use it and where to find the information they need for their studies, and some habits they had when using the platform, for example, to communicate.

The experience domain researched by Sanders (2001) describes user experiences and inspire designers to understand user needs. The methods used in this research helped participants to think through the phases of the experience domain. The outcome was similar for the past and present phase, but the result elicited in the future phase was different.

In the semi-structured interviews, participants individually suggested a future scenario with multiple additions to solve their problems. In contrast, this future scenario was more oriented in the generative techniques to improve and use the platform's features more. It suggests that semi-structured interviews help people reach a deep level of knowledge and identify needs, but not to think about solutions that tackle the root problem in a future scenario. While with the generative tools, people, though collectively, analyzed, and proposed in-depth solutions to tackle root problems in a future system.

For example, In the interviews, participants were more oriented to add new features to encourage them to communicate more. Simultaneously, in the generative session, people were more aware that the root problem was a lack of participation within all the system users and not the lack of communication features.

The fact that follow-up questions are the main characteristic of the semi-structured interview (Wilson, 2014) and can help participants to reach a future experience contradicts the point argued by Visser et al. (2005) that says that interviews can not provide much input from participants towards the future. Also, the follow-up questions contribute to the argument made by Robertson (2001), establishing that interviews can elicit the undreamed type of requirements.

This research proves that it is necessary to make follow-up questions, so participants can imagine the dream version based on problems they have detected. It seems to help participants create a link between what they say, do, and dream. Besides, it contradicts the initial assumption that only with generative techniques would it be possible to reach a deep knowledge level.

This research provides new insight into the undreamed type of requirements and semi-structured interviews. When participants were asked about an ideal or dreamed version of the technology, both methods provided outcome, as was expected from the experience domain and the undreamed type of requirements elicitation through a semi-structured interview. The difference is in the kind of suggestions participants made in each method.

With regard to the type of requirements that participants can communicate in the user requirement elicitation phase, participants mentioned functional requirements (Bevan et al., 2018) positively and negatively and identified suggestions to improve. For example, features like the calendar do not show any information. Also, non-functional requirements were mentioned (Bevan et al., 2018) concerning positive and negative experiences and suggested changes for the ideal version, such as stylizing the content.

One assumption fulfilled was that with both methods was possible for participants to express past and present experience. Participants demanded fewer questions from the interviewer in the generative techniques since participants had time to think about their answers before. Besides, the online setting seems to help participants create a link with what they have experienced and change and do in the future for the generative techniques.

5.3 Research suggestions and practical contributions

Once this research was conducted online, for both research methods, a suggestion for future research might be to test the approach used in this research for generative techniques with a group of less experienced users using a computer and a web application such as Mural. Later, analyze if this group of participants can express their past, present, and future experiences and translate them into needs and requirements for using a specific technology. Considering the user requirement from less experienced users of a system, this might be a difficult task.

For future research, this comparison between the generative techniques and semi-structured interviews can be conducted by including different groups of stakeholders besides the end-users. Involving other groups of stakeholders might provide multiple opinions, memories, and experiences using a specific system. Therefore new similarities and differences might be found for these two types of research methods and a novel list of requirements to improve the Canvas platform if it is part of the research goal.

Sleeswijk Visser et al. (2005) considered in generative research a phase of sensitization. This phase consists of preparing the participants for the group sessions by encouraging them to think about the topic or topics related to the research. This phase requires organizing some activities, sending them to the home of participants, and can last one or two weeks. Due to this research's short time, it was impossible to consider a sensitization phase in this research. In addition, the participants were in constant use of the technology used for this research, the Canvas platform, during the study period. Either way, including a sensitization phase, can be considered for further study of the same comparison made in this research and analyze if it influences the outcome.

In both research instruments, the semi-structured interviews, and the generative techniques, the questions were related to the thoughts, daily use, and an ideal version of the Canvas platform. One suggestion for further research is to ask about the experience of studying outside this platform. It is related to their habits outside the system on how they prepare for their academic activities and commitments. This addition could help to know more about personal experiences that might help detect other similarities and differences between the study's compared research methods.

Although this research aims to compare two methods of collecting user requirements, this research's practical contribution is to analyze all the suggestions and changes the participants mentioned in the research sessions and thus adapt them to improve the Canvas platform and its use at the University of Twente.

Both methods provide requirements from users; in this case, users from a learning management system. The resulting lists of requirements can be analyzed to define what can be implemented on the Canvas platform as is used by the University of Twente. Semi-structured interviews provided an extended list of requirements for a future version of a system that could be analyzed and define functional requirements. In contrast, the generative sessions provided a shortlist of suggestions to improve the platform and can be more suitable to include in the Canvas system.

Lastly, this research's practical contribution is for researchers with a small budget; it is possible to conduct remotely generative techniques and reduce the number of resources invested in conducting user research, such as time, in obtaining user's requirements. Since both methods have more similarities in the outcome than differences, this practical contribution might help the design team invest a small number of resources in understanding its users.

Some considerations need to be considered with the participants and some technical limitations to conducting generative techniques online. In the generative sessions, a situation occurred in which one participant deleted her artifact of the first activity related to the thoughts about the Canvas platform. In the workshop outcome file, this information was not there, but it was possible to rescue her thoughts thanks to the audio recording.

The technical limitation encountered during the research was the problems of connection from participants, especially in the generative sessions. This problem is sometimes limited to listening to opinions. The sudden absence of participants, causing small pieces of information to be lost or, in some cases, took time from the session for the participant to repeat their ideas.

5.4 Limitations

The Kappa value means a certain level of agreement. Values between .40-.59 mean that there is a low value of the agreement. Values between .60-.79 mean there is a moderate value. Between .80-.90 means, there is a strong value of the agreement, and above .90, the agreement level is almost perfect (). This study has a value of .61, meaning it has a moderate agreement between coders, but it could not be improved to obtain a strong agreement due to time constraints.

Some participants were master students in a thesis phase, expressing that they do not use much of the Canvas platform. Participants were able to think of past and present experiences, but being in the thesis phase and not using the platform might influence these participant's perceptions of what a future version of the Canvas platform might be.

Students from their first year of bachelor's did not have enough experience using the platform. They had encountered some problems and have detected some positive experiences, so this short time using the system could also influence their thoughts and experiences and potential suggestions for the technology's ideal version.

The participant's availability in the generative sessions influenced the distribution per session. The criteria to organize each session was when all the participants match in time. Also, it influenced the time the sessions lasted. If one of the participants delayed, the researcher had to postpone the start of the activities. In some cases, the time planned for individual exercises or group discussions had to be reduced to comply with the session schedule fully. In cases where a section's time had to be reduced, this may have influenced the participants' opinions and thoughts, as time pressure may have limited further reflection on the question asked in that activity. Therefore, for further research, the generative sessions should be of 120 minutes.

Even though the researcher explained the Mural platform features used for the generative, some participants were not so skilled to use all the resources for the activities, so this took time from participants and reduced their possibility of having more time to work on their artifacts.
The connectivity to the mural platform also influenced the participant's performance. The time it takes for the platform to load the resources consumed time from the participants.

The scope of this research was not on how people feel and interact in research methods applied online. It might be possible that some participants did not feel comfortable sharing opinions and experiences through an online platform.

5.5 Conclusions

This study provides insight into the understanding of the experience domain and methods to elicit information from people, and the comparison of the interviews and the generative techniques gave expected and unexpected results

The semi-structured interview as a traditional method for user requirement elicitations is useful. The follow-up questions let the end-users think in all the phases of the experience domain. Participants were able to remember past experiences, express present experiences, and build on a system's future scenario. One of the cons of this method is the result of suggestions to improve the Canvas platform resulting in a big list of additions that might not be possible to implement. Another positive thing about this method is that participants think and communicate the functional and non-functional requirements.

Concerning the generative techniques, the pros of using this method are that it helps end-users express all the experience domain phases and communicate the latent needs and their tacit knowledge concerning the use of specific software technology. The cons of conducting generative techniques using an online platform are that participants with a minimum of experience using similar collaborative platforms, such as Mural. Another con is that remote research requires technical features such as a platform for video calling that might influence participants' collaboration.

The generative techniques represent a new creative method for user requirements elicitation. Like the semi-structured interviews, this approach can also be applied online, taking into account the necessary technical features.

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Appendices

Appendix A. Semi-structured interviews participant information

Table 1

Participant number	Academic level	Study program	Gender
Participant 1	Master	Education Science and Technology	Female
Participant 2	Master	Nanotechnology	Male
Participant 3	Master	Education science and technology	Male
Participant 4	Phd	Plus - people land and urban systems	Male
Participant 5	Master	Geo Information and Earth observation and Natural Resource Management	Male
Participant 6	Master	Philosophy of science and technology	Male
Participant 7	Bachelor	Psychology	Female
Participant 8	Bachelor	Psychology	Female
Participant 9	Bachelor	Communication Science	Female
Participant 10	Master	Communication Science	Female
Participant 11	Master	Human computer interaction and design	Male
Participant 12	Bachelor	Communication Science	Female
Participant 13	Bachelor	Communication Science	Male
Participant 14	Bachelor	Psychology	Female
Participant 15	Bachelor	ATLAS program	Female

Participant 16	Bachelor	ATLAS program	Male
Participant 17	Master	Geo Information and Earth observation and Natural Resource Management	Male
Participant 18	Bachelor	Communication Science	Male
Participant 19	Bachelor	Communication Science	Male
Participant 20	Bachelor	Psychology	Female

Appendix B. Semi-structured Interview instrument

Procedure: Once the participant agrees to be part of the research, a link will be sent to the video meeting platform. This link will be sent by email. At the beginning of the interview, the participants will give their consent to record the audio for the next steps.

Goal: The goal of this interview is to learn from student's experience using the CANVAS platform, also to know what they like, what they do not, and how the ideal or dream platform could be.

Questions:

Phase	Questions
Introduction	What program are you studying in the UT? Are you following an specific specialization? In what year of your studies you are?
Feelings towards using the platform	What do you think using Canvas? **Follow up question:** -*What do you think about the platform's means of communication?* -*what do you think about how the content organization in Canvas?* -*What do you think about the different tools that the platform offers?*
Daily life experience	What is your day to day experience using Canvas? **Follow up question:** -*Can you a describe how you make use of Canvas on an average day?* Based on the different courses(subiects) you take, What features you use the most in Canvas? **Follow up question:** -*What is your experience using the content on Canvas?* What is your experience communicating through Canvas? **Follow up question:** -*how useful do you find them?*

Ideal version of Canvas	Could you describe your ideal version of Canvas platform? **Follow up questions:** -*What features could be added to support your academic performance?* -*What features could be added to communicate through Canvas?* -*What features could be added to organize the content in Canvas?*

Appendix C. Generative techniques participants distribution

Table 2.

Generative techniques participants background and information

	Academic level	**Study program**	**Gender**
Session 1			
Participant 1	Master	Interaction Technology	Female
Participant 2	Master	Urban Planing	Female
Participant 3	Phd	Educational Science	Female
Participant 4	Master	Interaction Technology	Male
Participant 5	Master	Systems and control	Male
Session 2			
Participant 1	Master	Embed Systems	Male
Participant 2	Master	Interaction Technology	Female
Participant 3	Master	Communication Science	Female
Participant 4	Master	Geo-information Science and Earth observation	Female
Participant 5	Master	Geo-Informatics	Male
Session 3			
Participant 1	Master	Communication Science	Female
Participant 2	Bachelor	ATLAS program	Female
Participant 3	Bachelor	Business and IT	Female
Participant 4	Master	Interaction Technology	Male
Participant 5	Master	Construction Management and Engineering	Female
Session 4			
Participant 1	Bachelor	Creative Technology	Male
Participant 2	Bachelor	Industrial Design	Male
Participant 3	Master	Geo-information Science and Earth observation	Female
Participant 4	Master	Urban Planing	Male
Participant 5	Master	Communication Science	Male

Appendix D. Generative techniques procedure

Procedure: This session will begin with a online meeting using the Jitsi platform. In this step the activities will be explained and the link to the Mural platform will be shared using the Chat feature. Once the participants enter the layout in Mural Platform, the researcher will explain the features that will be used and for them to pick one space to work.

After the Warm up activity, the participants will give their consent to record the audio for the next steps.

Link to Mural: https://app.mural.co/t/generativesessionsthesis5002/m/generativesessionsthesis5002/1587629616236/7a1a291632dc67f53996d2640274bfc9c28068d6

Goal: The goal of the generative sessions are to know the experience, the daily routine using CANVAS platform and imagine the future or ideal version of the CANVAS platform.

Activity	Instruction	Time
Mural introduction	Explain briefly the platform features	
1-. Warm up activity	Each participant will introduce themselves, mentions their name and type of study, and using the image feature, search for a hobbie and add it on their working space.	5 min,
2-. Making exercise *What do you think of using Canvas platform?*	Individual activity Using the images, sticky notes, pen tool can you express the feelings and thoughts you have while using the CANVAS platform features and course pages.	5 min
Could be drawing, image, mind map every participant creates a piece and explains to the group	Presentation and group discussion -*What do you think about the platform's means of communication?* -*What do you think about how the content organization in Canvas?* -*What do you think about the different tools that the platform offers?*	10 min
Total time		15 min
3-. Cognitive mind mapping *What is your day to day experience using canvas?*	Individual activity Using the images, sticky notes, pen tool can you describe a daily day using the CANVAS platform, also can you mention, what features you use more and how the course pages are usually organized.	10 min

	Presentation and group discussion	15 min
Participants express their day to day using canvas platform. Participants can use: sticky notes, images, icons, pen to write and draw, lines and arrows	What is your day to day experience using Canvas? **Follow up question:** -*Can you a describe how you make use of Canvas on an average day?* Based on the different courses(subiects) you take, What features you use the most in Canvas? **Follow up question:** -*What is your experience using the content on Canvas?* What is your experience communicating through Canvas? **Follow up question:** -*how useful do you find them?*	
Total time		20 min
4-. Create ideal platform *What is your ideal version of Canvas*	Individual activity Using the images, pen tool, and sticky notes, can you create the ideal CANVAS platform, how do you see this tool as a complementary for your studies.	5 min
In this exercise, participants express how they dream for the near future canvas platform participants can use the draw platform, add post-it upload images	Presentation and group discussion	15 min
Total time		20 min

Appendix E. Codebook

Code book		
Category 1:	Use of content	
Description:	This category refers to codes that were mentioned about the experience of using the content of the Canvas platform	
	Code	**Description**
	Content structured	
	Content for the lectures	
	Useful platform	
	Inconsistency between teachers	
	Easy to access content	
	Confusing access to content	
	Canvas is better than competition	Competition means to similar platforms
	Calendar unuseful	
	Downloading material	Neutral code: does not refers to a positive or negative mention
	Easy to use	
	Time consuming	
	Upload assigments	Neutral code: does not refers to a positive or negative mention
	Easy to upload	
	Use of modules feature	Neutral code: does not refers to a positive or negative mention
Category 2:	Communication	
Description:	This category refers to codes that were mentioned about the communication experience of participants with Canvas platform	
	Code	**Notes**
	conference calls feature is useful	
	no communication through canvas	
	email to communicate with professors	
	effective to communicate	
	Notifications are effective	
	use of conferences	Neutral code: does not refers to a positive or negative mention
	feedback provided efficently	
	Discussion board is useful	
	announcements feature	Neutral code: does not refers to a positive or negative mention
	announcements are helpful.	
	feedback can be a little bit confusing	
	group communication	Neutral code: does not refers to a positive or negative mention

	group work meetings	Neutral code: does not refers to a positive or negative mention
	using the discussion board	Neutral code: does not refers to a positive or negative mention
	conference feature is confusing	

Category 3:	Suggestions to improve
Description:	This category refers to additions participants made for Canvas platform

	Code	**Notes**
	improve content organization	
	standardized way to organize the course	
	centralized platform	
	Add chat feature	
	improve assignments section	
	delete unused features	
	Add a group workspace	
	customizable course organization	
	Improve communication	
	improve discussion interaction	
	Add contact details	
	improve grade feature	
	improve group communication	
	Improve people section	
	Add folders for content organization	
	Add search bars	

Appendix F. Use and management of the platform's content

Table 3

Code order of Use and management of the platform's content

Code	Number of mentions	Code	Number of mentions
Semi-structured interviews		Generative Techniques	
Content structure inconsistent	43	content structure inconsistent	23
Content structured	41	content structured	16
Content for the lectures	29	inconsistency between teachers	15
Useful platform	26	calendar unuseful	13
Inconsistency between teachers	25	professor responsability to organize content	11
Easy to access content	23	**canvas is intuitive**	11
Confusing access to content	19	canvas is better than competition	9
Canvas is better than competition	15	easy to access content	9
Calendar unuseful	14	**use canvas only when is need it**	9
Downloading material	13	Confusing access to content	7
Easy to use	12	downloading material	7
Time consuming	11	use it to check content	7
Upload assigments	11	**group work effective**	6
Easy to upload	10	short use of canvas	6
Use of modules feature	10	useful platform	6
		confusing submit assignments	5
		privacy issues concern	5

Note. The codes in bold, are unique codes mentioned in each research method

Appendix G. Interaction between users and the platform

Table 4.

Code order of Interaction between users and the platform

Code	Number of mentions	Code	Number of mentions
Semi-structured interviews		Generative Techniques	
conference calls feature is useful	43	conference calls feature is useful	12
no communication through canvas	30	Notifications are effective	11
email to communicate with professors	21	**communication is confusing**	10
effective to communicate	14	Discussion board is useful	9
Notifications are effective	14	feedback can be a little bit confusing	6
use of conferences	14	no communication through canvas	6
feedback provided efficently	13	**unnecesary notifications**	6
Discussion board is useful	12	feedback provided efficently	5
announcement feature	11	feedback provided inefficent	5
announcements. That's really helpful.	10	Announcement feature	4
feedback can be a little bit confusing	10	discussion board unused	4
group communication	9	**Announcement feature unuseful**	4
group work meetings	9	**discussion board inneffective**	3
using the discussion board	9	**notifications are useless**	3
conference feature is confusing	7	conference feature is confusing	2

Note. The codes in bold, are unique codes mentioned in each research method

Appendix H. Suggestions to improve the platform

Table 5.

Code order of Suggestions to improve the platform

Code	Number of mentions	Code	Number of mentions
Semi-structured interviews		Generative Techniques	
improve content organization	28	standardized way to organize the course	20
standardized way to organize the course	20	centralized platform	11
centralized platform	17	improve notification sent	11
Add chat feature	13	improve discussion interaction	8
improve assignments section	11	**improve message communication**	7
delete unused features	10	customizable course organization	7
Add a group workspace	8	improve calendar feature	7
customizable course organization	8	add storage files feature	6
Improve communication	8	add visual features for content	6
improve discussion interaction	8	**improve group grading**	4
Add contact details	7	Add a group workspace	4
improve grade feature	7	improve assignments section	4
improve group communication	7	improve grade feature	4
Improve people section	7	Add chat feature	3
Add folders for content organization	6	delete unused features	3
Add search bars	6		

Note. The codes in bold are unique codes mentioned in each research method

Appendix I. List of singular additions from the interviews

Table 6.

List of additions suggested in the interviews

Code	Number of mentions
Semi-structured interviews	
add academic sources engine	3
add a detailed course performance	1
add a forum on course module	2
add additional content	3
add alphabetical filter	1
add an archive feature	1
add an batch downloads feature	1
add an upload batch of files feature	1
add comment feature	1
add conferences from Canvas	1
add day planner tool	3
add done feature to assigments	1
add events section	1
add feedback page	3
add G drive	1
add grade details	1
add learning goals	2
add Q&A recording from online conferences	1
add relevant academic content	2
add scan feature	1
add storage files feature	1
add tests features	2
add tips or tricks	1
add visual features for content	2