

User-Experience based Evaluation of the Jaxber App

**Towards competitive advantage through a study of
User Experience**

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Bachelor's Thesis
May 2020
School of Business
Degree Programme in International Business

Author(s) Montero Terán, Heidy Noelia	Type of publication Bachelor's thesis	Date May 2020
		Language of publication: English
	Number of pages 75	Permission for web publication: x
Title of publication User-Experience based Evaluation of the Jaxber App Towards competitive advantage through a study of User Experience		
Degree programme Degree Programme in International Business		
Supervisor(s) Krawczyk, Piotr & Pallot, Marc		
Assigned by		
<p>Abstract</p> <p>Technology has revolutionised the way that companies are run, and the competition between enterprises is fierce as breakthrough developments occur daily in the IT industry. Hence the sustainable development of competitive advantage is a priority for any enterprise wishing to survive, let alone excel on the market. User-Experience (UX) is one of the possible contemporary approaches aiming at achieving a competitive advantage. There are different models proposed for UX evaluation to address the user's needs efficiently. The objective of the study was to evaluate the user experience of the Jaxber mobile app as a potential source of competitive advantage and to find out which of the selected properties have changed over the years 2017 – 2018 and to inform the future development of the Jaxber app. A Holistic Model for UX evaluation was used as a theoretical framework in this study.</p> <p>A repeated cross-sectional mixed-methods study was implemented based on qualitative and quantitative secondary data provided by the organisation. ANOVA analysis and the Nonparametric Kruskal-Wallis Test were used for quantitative data analysis, and sentiment analysis and the cloud of terms were applied to qualitative data.</p> <p>The triangulation of results revealed that quantitative and qualitative results are complementary to each other. There was a statistical change for three (usefulness, novelty, and productiveness) of the seven selected properties. Sentiment analysis showed that the general opinion of the users of the Jaxber app is positive.</p> <p>Recommendations for improvement of the Jaxber app that came from the end-users of the mobile solution, when prioritized and implemented, may become a source of possible competitive advantages in the future.</p>		
Keywords/tags (subjects) User Experience Jaxber, Mixed-Methods, Repeated Cross-Sectional study, Competitive Advantage		
Miscellaneous (Confidential information)		

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1 Introduction

1.1 Background

Nowadays, concepts such as change, innovation, and improvement often are considered as a motto for company operations. In the technology industry, the majority of companies emphasise the importance of user-centricity and user experience in accomplishing product differentiation and customer satisfaction in target markets. Many enterprises, both service and product-oriented, in particular within the technology industry, find that understanding user-needs represent one of the highest priorities and challenges.

As Spolsky (n.d) stated, *"listen to your customers, not your competitors,"* it is necessary to analyse what areas have a substantial impact on the user experience. The approach requires that companies will be able to develop a competitive advantage by delivering features and fulfil the needs of its customers with the feedback or comments provided by them. The area of Innovation Management that reflects this field is named User-Centric Design.

Despite the general importance of User Experience (UX) in the design of products or services, it has been applied recently in the industrial sphere. Based on the historical evidence gathered in articles UX raised to counterweight the "Machine age philosophy" with its main representatives Henry Ford and Frederick Taylor, which were characterised by stating the importance of machines over people (Where UX Comes From 2013). On the other hand, one of the pioneers in proposing UX philosophy was Henry Dreyfuss with the book *Designing for People* in 1955, in which he states, *"If the point of contact between the product and the people becomes a point of friction, then the industrial designer has failed. If, on the other hand, people are made safer, more comfortable, more eager to purchase, or just happier, the designer has succeeded"*. (24.)

The contribution of Dreyfuss to the academy provided a concise and general idea about the UX and its importance. However, the term UX was coined in 1995 by Donald Norman. His principal idea was that experience is a result of a chain of interactions between product and user integrally; in his opinion, the field of cognitive science has a strong influence when evaluating these outputs.

Therefore, the importance of the role of the designer and the interaction that users will have with a specific product; as a result, the designer's creation was highlighted (Stevens 2019). In this way, the relevance of users, their opinions, experiences, and feelings towards a product are a valuable input for companies (ibid). This is why they should be analysed systematically.

Jaxber is a cloud-based mobile app where users can be engaged through gamified campaigns comprised of multiple challenges including but not limited to video, audio, picture, text capture, and qualitative and quantitative surveys (Jaxber 2019). The use-case scenarios of Jaxber range among other fields from business, the world of academia, service providers, to the public institutions and the focal area of this study is education.

1.2 Motivation for the research

The importance of competitiveness in a company and specifically a mobile app can be measured by the number of users that are in constant contact with or use of it. There are 6 140 apps that are launched in every day in Play Store (Statista 2018) designed for Android system, and there are 2.1 million of existing apps in App Store designed for iOS software (ibid). Consequently, the competition in software development is high, and the nature of the software industry is dynamic; hence the market is hyper-competitive.

According to Fundin and Bergman (2003, 58), it is of high relevance to develop a systematic process for obtaining feedback from users, not only to correct misleading features of a product but also to capture and analyse essential information in order to develop a new product or create a new feature for a product that can be suitable for different markets. Thus, it is vital for Jaxber as a company to analyse the areas that have changed in the user experience of the app to develop new or improve the existing features.

On a societal level, to understand the motivation of this thesis, it is vital to emphasise the importance of the mobile app user experience in the context of education and its quality. The United Nations Organization proposed a plan of the seventeen sustainable development goals in order to promote high-quality life as well as to ensure the human rights by the year 2030 (UN 2019). The goal number fourth is quality education and states that it is the foundation for creating sustainable development in a country; also it addresses the fact of "quality" in its explicit meaning, where there is a need for the right tools for an integral education like an adequate environment, and equal access to technology (ibid).

In this context, the variety of possibilities of using the Jaxber app in different school environments such as middle school or universities constitutes an essential motivation for this research. The app can be used as a collective learning diary in which students and teachers can have interactions about specific topics. Teachers have the possibility of creating campaigns defined as spaces for interaction on a determined topic; students are able to share comments in textual form as well as audio, picture, or video format.

The cloud-based mobile app allows the teachers and students to capture and save the collected information and use it later for pedagogical and academic purposes (Jaxber 2019). Furthermore, the app is available free of charge in both Android and iOS version, which ensures equal access to it for the students.

On a personal level, the motivation of the researcher to focus on this topic is reflected in her interest in education in general and User Experience as a subject in particular. The researcher considers that education is the pillar of the success of a country, and it ensures the quality of life of individuals. The researcher being a student, knows how important is the technology for providing an integral and high-quality learning experience. Consequently, this study will contribute to an early stage of exploratory research for evaluating the user experience of students to improve and further develop the Jaxber app. The assumption is that a more user-friendly and reliable solution may improve the quality of education for the students going through the learning experience based on the Jaxber App in the future.

UX is becoming a trend and a new perspective on developing products or services where besides the economic value, the voice of users and the society has taken centre stage. Hence, the results of this research may help the team of Jaxber software developers to understand what are the UX properties that have an impact on User Experience. At the same time, this real-life business environment provided the researcher with an opportunity to broaden the knowledge about the topic in question, enrich the skills in quantitative and qualitative data analysis, as well as improve the writing skills.

1.3 Research problem, question and objective

Over the last five years, Jaxber app has been used by hundreds of students across different educational programs in countries such as France, Germany, Spain, Hungary, Slovenia, Poland and Finland. There is a substantial record of data collected to evaluate the UX experience of the app. Nevertheless, there is no research done to-date that would have analysed the data set from more than a single year.

Technology changes dynamically and this research focuses on the evaluation of comparable data sets captured within the two years (2017 and 2018) for determining what possible improvements based on UX evaluation could be implemented in Jaxber App as a competitive advantage.

Research Question and Objective

The study aims to address the following two generic research questions and two related objectives:

Research Question 1 (Answer in 4.1 & 4.2):

Which of the selected UX properties of the Jaxber App, if any, have changed as perceived by the users between the year 2017 and 2018?

Research Objective 1:

To find out, through the use of the repeated cross-sectional mixed-methods user-experience evaluation study, which of the selected UX properties of the Jaxber App have changed as perceived by the users between the years 2017 and 2018

Research Question 2 (Answer in 4.2.2):

Which of the selected UX properties of the Jaxber App, if any, could be a source of competitive advantage?

Research Objective 2:

To identify potential sources of competitive advantage through analysis of secondary data collected by mixed methods user-experience survey instrument.

To answer the generic question, the research will consist of the analysis of secondary data. The two (2017 and 2018) sets of quantitative and qualitative data are collected through a bipolar questionnaire, including its rating justification that was filled out by the students at Finnish and French universities. Saunders, Lewis and Thornhill (2009, 269) explained the importance of existing secondary data because it enables to compile information and obtain comparative results among the possible findings.

The UX holistic model proposed by Pallot and Pawar (2012) was chosen as a theoretical framework because it categorises different properties of UX into dimensions like human, societal, or business (13).

1.4 Thesis Structure

The thesis will consist of a total of five chapters. In chapter 2, the fundamental concepts of the topic will be introduced in the form of a literature review in order to collect and contrast existing knowledge that will help to understand and answer the research question. In chapter 3, the methodology of the research will be explained in detail. In chapter 4, the results of the analysis will be communicated in a concise way and in concordance with the research objectives. Finally, chapter 5 will be dedicated to the discussion about the areas of UX that had an impact on the Jaxber app user experience, limitations of the study, and suggestions for further research.

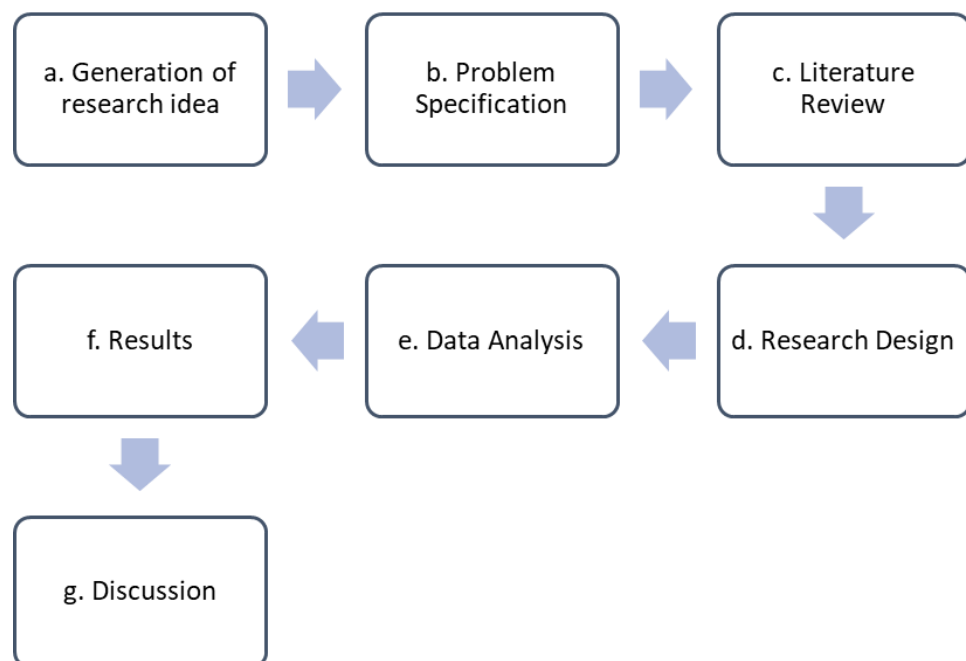


Figure 1. Thesis Structure Overview

2 Literature review

2.1 User Experience Definition

Even if we treat User Experience (UX) as a singular concept, there are different interpretations of it. Lallemand, Gronier and Goenig (2015) outlined that even though UX is one of the main concepts of Human-Computer Interaction (HCI), there is not a universal definition for it. Hence it is important to discuss what different authors perceive as UX in the product development context.

According to the User Experience Professionals Association (2008), UX is defined as the interactions that the user has with a product or service as a whole in all its aspects; therefore, the importance of a holistic design that is understandable for users is highlighted. In the same line Nielsen Norman- Group (2006), defines the term as *"all aspects of the end-user's interaction with the company, its services, and its products"*. These definitions address the term in a generic form; moreover, it is essential to break down the concept for further analysis.

As Norman (2006) stated in its first steps towards the definition of UX, the field of cognitive science is directly related to it, because the product interactions will result in an experience. Lauralee (1996) precise, is meaningful information the way the product feels in hands, how users understand its usability, how well it matches its purposes as well as how well it fits the contexts where it should work (10). If a product generates a positive outcome in these perceptions, it will have a final positive UX experience.

Other definitions go further and focus on the buying process and how this can affect user perception in its UX experience. According to Hassenzahl and Tractinsky (2006, 93), the expectations, predispositions, and motivation for buying a product will also influence the final output of UX. The reason for this statement relies on a fact addressed by the International Organization for Standardization where is explained that there is the need of prior knowledge, skills, and a context of the use of a product

in order to fulfil the customer needs; previous experiences might influence user behaviours as well. For example, it is not enough to buy a sophisticated printer if the user is not able to understand the function of each feature. (ISO DIS 9241-210, 2010, 95.) Another relevant concept is the meaningfulness of the interaction, which means that besides fulfilling a need, the user has to enjoy that experience and remember it beneficially (Hassenzahl & Tractinsky 2006, 94).

Nyman (2005), aggregates a critical factor concerning the supply chain of a product or service. In his work, mentions that the importance of UX is based on the final perceptions of the end-users. The rest of the interactions are valid, moreover not essential to the product, its structure, or its functionality. Nyman also emphasises the significance of the emotions that a user has towards the product and how these will transform into a vision or a comment that is valid into accounting UX (ibid). Another field that is related to UX outcomes is the business sphere.

Gerken and Jetter (2006) discussed that not only reliability and usability are relevant but also market, novelty and concepts from industrial or visual design should be stipulated in concordance to the purposed delivery brand proposition (109). In the same way, Hekkert (2006, 160), discuss the design of a product and the effectiveness of the aesthetic design and visual experience is a factor that will determine expectations. Nevertheless, the previous authors failed in determining the importance of the concept "expectation" in the evaluation of UX. Unlikely Hassenzahl and Tractinsky (2006, 95) purposed the importance of expectation as a measurable experience.

Overall, UX consists of smaller experiences that, when joint, will lead up to a result about the thoughts of a user. (Roto 2007, 32). In UX, there are different variables that will lead to the final picture. These can be technical (reliability, usability, design), contextual (related to user feelings, knowledge, experiences, and expectations), finally cognitive (related to human sensation) (ibid). Ideating an integral definition of

UX will help to the future researchers to understand and evaluate UX in a holistic approach.

2.2 Contrasting types of Experiences in UX Evaluation

There are different experiences that can be produced from the interactions of the user and the product; therefore, the "experience" concept has to be broken down. Even though Experience and User Experience (UX) are concepts with different connotations are frequently used as they would have the same meaning. According to the Oxford dictionary, the meaning of experience is "*the knowledge and skill that you have gained through doing something for a period of time; the process of gaining this.*" This definition is applied in a general context; hence it can refer to different actions not necessarily related to UX.

According to Roto (2007, 31), researchers often do not differentiate these conceptions in their publications. An experience is related to the output of interactions perceived by the human cognitive system; not all these experiences will involve a product or service as it is a key requirement in UX. For example, walking through a forest in the morning is an experience but does not apply to UX because there is not a system involved. (ibid, 33.) Therefore, the experiences that will help to analyse the product and its functionality at different levels (aesthetically, usability, reliability) will be the output of the specific interactions with the product or service (ibid, 34).

UX is the result of a process of abstraction of the main characteristics that a product or service has in primary contact with the user. That is why below the types of experiences proposed by different authors (Roto 2007; Hassenzahl 2003; Desmet & Hekkert 2007) will be reviewed.

Expected Experiences at UX, this is a concept that, according to Roto (2007, 32), it is originated before the actual interaction of the user and the product or service. This experience is a result of the expectations that are generated by three main factors

such as (a) advertisement, branding concepts promoted by companies, (b) aesthetic elements of the product (size, smell, colour, texture); and (c) third party references that can be positive or negative (ibid). These elements have a meaningful influence on the purchasing decision that the user will have on the product.

Experience During Interaction, this phase directly affects the perception that a user has towards a product; for this reason, it is critical to do research, especially in this type of experience (ibid, 33). The primary purpose is to generate an experience that correlates what customer knows and expect with the correct usability of the product or service. (See figure 2)

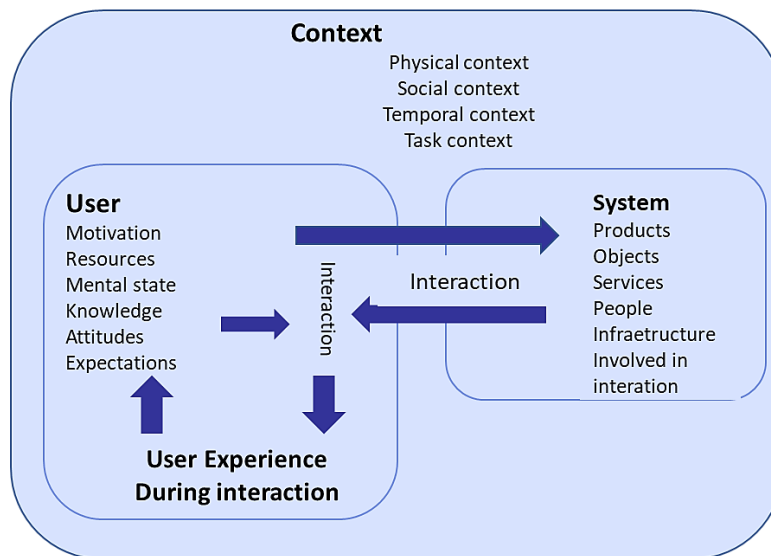


Figure 2. UX During Interaction (adapted from Roto 2007)

Post Interaction Experience, in order to comprehend the results of the given interactions according to Hassenzahl (2003), the post-interaction experience is conformed by meta experiences the same that arise after a process of reduction and abstraction of the product characteristics gained through the previous stages in the experience model. These are simplified and focused on the most meaningful aspects for the user, can be positive or negative impressions (ibid). The motive why meta-experiences are decisive is because these are the conclusions that users keep as

memories; these outcomes can be used to develop further research within the framework of consumer needs.

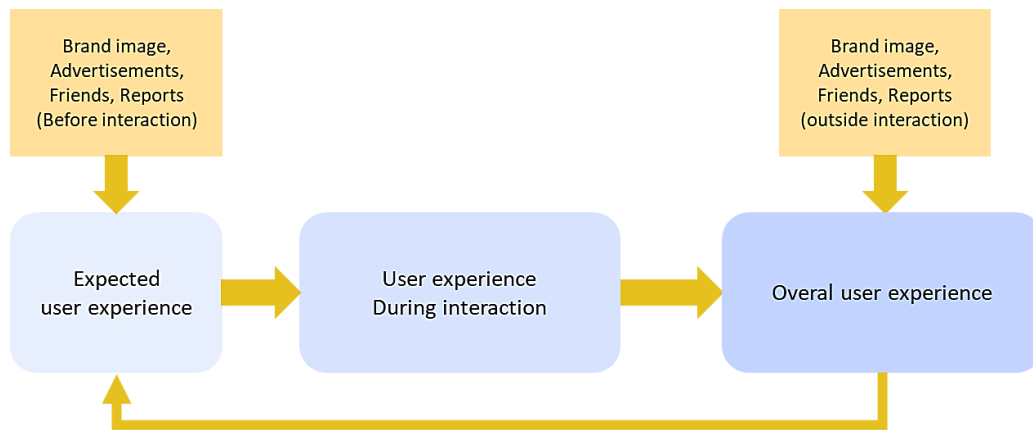


Figure 3. Different Experiences at UX (adapted from Rooto 2007)

In the same context of the analysis of different types of experiences, Desmet and Hekkert (2007, 15) proposed a different model that contemplates the concept of "experience" with a framework that interprets human interactions with products on different levels. They refer to the model as "product experience" and stipulate that in order to understand the role of UX in the design of a product is substantial to review the varieties of human interactions with a product.

Consequently, there are (a) instrumental interactions referring to the ones that involve the use of the product or service for its main purpose, (b) non-instrumental interactions related with the experiences that involve external interaction with the product but not using it for its objective and (c) non- physical interactions alluding to the experiences that user has while thinking about the product or anticipating its user (ibid.) The named interactions generate experiences; these have a direct relationship with the affect of a user towards the product.

As stated by Hekkert (2006), there are three elements to analyse the product experience in a global view: aesthetic pleasure, attribution of meaning, and emotional response. Subsequent a detailed explanation of these experiences.

Aesthetic Experience, it can be considered as the first level of experience between user and product because it involves external characteristics of the product that will lead to the most common sensorial experiences in the human being such as the smell, how good it looks like, the textures among others (Desmet & Hekkert 2007, 16). In this stage, the user is able to recognise the familiarity or novelty of the product; depending on the impression of the product; the user will decide to keep on the interaction or no, hence is a fundamental stage (ibid).

Experience of Meaning, in this level, the user can associate the product with its personality. Desmet and Hekkert (2007) remarked that once the external properties are processed into a cognitive level, the user is capable of assigning characteristics to the product; this can be subjective and have a different symbolic meaning to every user (17). These reactions may vary depending on the target customer because cultural differences can have an impact on what is defined as luxury or beautiful, and these conceptions will determine the relationship between product and customer. Govers and Mugge (2004) affirm that customers tend to develop attachment towards products that considered to have a similar personality as they have rather than when there are markable differences.

Emotional Experience, this level refers to the emotions that can emerge from contact with the product (Desmet & Hekkert 2007, 17). If a user is happy because the product exceeds expectations, if he is annoyed because he does not understand how the system works, if he is nostalgic because it reminded him of a childhood memory (ibid). Companies are looking for arising positive experiences and emotions to their customers because it is an efficient form to generate a vast impression and to establish a connection with the customer.

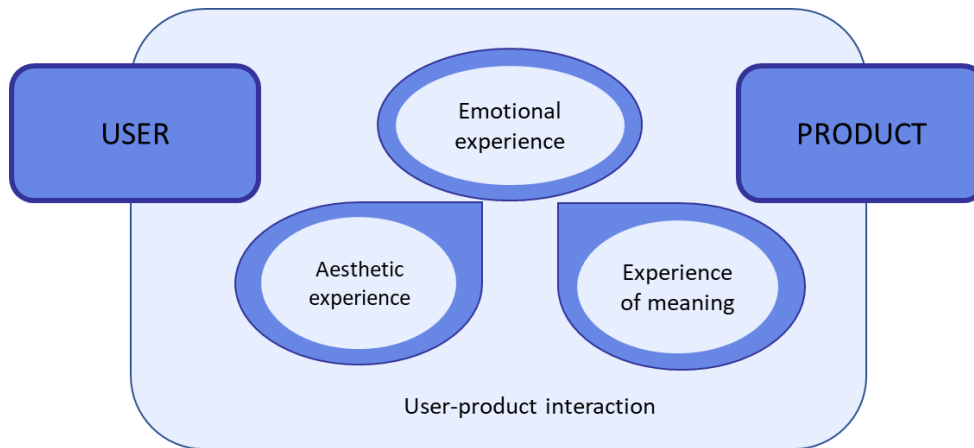


Figure 4. User - Product Interaction (adapted from Hekkert & Desmet 2007)

2.3 Product Development and UX

Nowadays, product development companies consider UX vital for commercial success (Kujala & Miron-Shatz, 2013). According to Pessoa and Trabasso (2017, 7), the product development process (PDP) is defined as *"the set of activities beginning with the perception of a market opportunity aligned to the company's competitive strategy and technical capacity, and ending in the production, sale, and delivery of a product."* User Experience (UX) has a relation with the PDP of different products with an emphasis on the technology industry.

The traditional product development life cycle comprises phases from the initial investigation, iterative design, evaluation and implementation (Roto, Nuutinen, & Smedlund 2014). Time after the product has been launched companies decide to collect feedback in order to understand better what users think about the product as well as launch support services (ibid). Human-centred design (HCD) focuses on the user and its needs gathering information and developing prototypes before the product is launched (ISO 9241-210, 2010). Gulliksen, Göransson, Boivie, Blomkvist, Persson, and Cajander (2003), exhorted that assuming a user-centred design attitude and including the final users into the process is crucial through the design stage when designing for a specific or desired UX.

Hartson and Pyla (2012) purposed a model where it is possible to observe different stages of the product development process that implements the UX. The model consists of four different stages analyse, design, prototype and evaluate (See Figure 5).

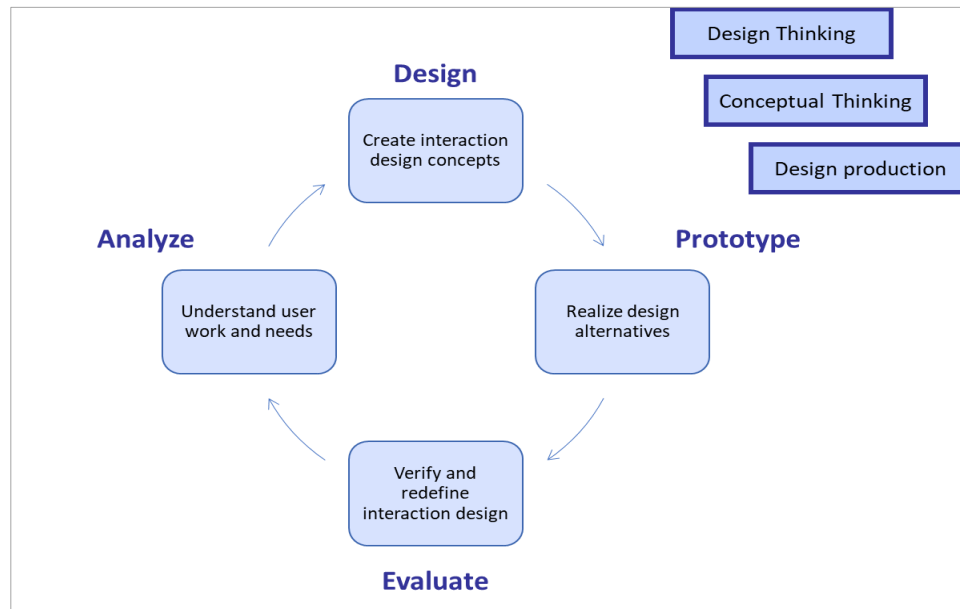


Figure 5. Product Development Process (adapted from Hartson & Pyla 2012)

Hartson and Pyla (2012), described that the analyse stage comprise the understanding of the context of the product and users as well as a depth view about the users' needs and requirements, this information is vital for the next stage of the process. The design stage is decomposed within "Design thinking", "Conceptual Design" and "Design Production". The purpose is to understand the whole UX lifecycle as an iterative process where ideas can be redefined and redesign. Bodker and Buur (2002), described the importance of the design stage, stating that the desire for long-term usability is a priority for business sustainability.

Prototyping is based on the information gathered on the previous stages into physical models which often are developed in parallel with the design phase; followed by the evaluation stage where is possible to redefine the interactions if necessary. Moreover, the model is only a base guide to understand the different

concepts and possible tasks and subtasks that each one contains, in practice, these activities can overlap; hence boundaries are not significant. (Hartson and Pyla 2012.)

2.4 The competitive advantage of UX

Competitive advantage and UX are linked as an intrinsic part of its roots in User-Centric Design (UCD). Sward and Macarthur (2007), described the relation of these two concepts, UCD is a philosophy that situates user as the centre of the activities concerning to design and aspire to humanise the interaction with technology. UX, as defined previously (see subchapter 2.1), seeks to understand and evaluate the interactions and experiences of the user in all its aspects within a specific product; the competitive advantage is a result of these evaluations.

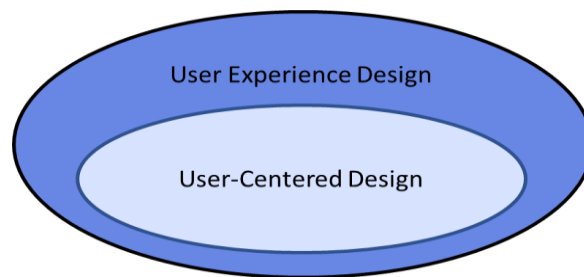


Figure 6. Relationship between UX and UCD (adapted from Sward & Macarthur 2007)

Additionally, UX is as well a link of communication and information sharing between the designer and the user of a finished product. The main reason why companies should pay attention to it is that it is possible to develop a competitive advantage with the collected information (Sward & Macarthur 2007). Amadeo (2019), defines competitive advantage as *"what makes an entity's goods or services superior to all of a customer's other choices."* In order to create a competitive advantage, there are two main factors to be considered; the benefit that products are offering and the

uniqueness of its specific features, as well as a detailed analysis of competitors and how similar, they are to the company (ibid).

In this context, the design is a powerful tool that can be used in order to attract, gain, retain customers and compete in different markets; especially in the development of mobile applications and the technology industry in general. The Design Management Institute (DMI) analysed the S&P companies over ten years and concluded that companies who are design-led have maintained its stock market significantly and eventually have outperformed its competitors in a 211% (DMI 2018). Therefore, based on the statics, UX evaluation in companies can become a tool for business strategy.

According to Grubbs (2018), UX can boost company operations because it can improve market fit offerings. Up to, 98% of new product ideas fail due to companies spend time and resources on developing a product that is not useful for the market (Mullins & Komisar 2009). This leads to significant failures in the software development cycle as well as the application of erroneous business models, and therefore, sub-optimal resource allocation of resources (Blank & Dorf 2012). UX design and evaluation is a process that can help to overcome these difficulties because its primary approach is to observe the customer and its environment in a practical way; as a result, there is an elucidation of critical factors about market fit.

When analysing UX and the whole context that surrounds the product or service (customer needs, desires, and market opportunities), teams at enterprises can understand the conditions under which they are performing from a holistic point of view. As a consequence, their efforts are not only focused on just "the product", as constant experimentation is also part of this process. (Rohrbeck, Günzel & Uliyanova 2012.) Relevant changes and improvements can be made as an output of the information gathered from UX evaluation through the time, leading to a high impact competitive advantage (Stubbart and Knight 2006, 85). Hence, the company creates systems of experience, not only products (Grubbs 2018).

Smith (2016) analysed the competitive advantage of UX factually; among its most relevant conclusions, there is the example of how Google which is worth 280 billion USD (Sean 2019) uses the constant evaluation by the observation of its customers to overcome its competitors by improving its systems. This vision is represented by its leading principles *"Focus on the user and all else will follow"* (Google Inc.) and has allowed the company to remove entry barriers as well as increase system confidence with its users.

Another practical example was explored by Rockwell (1999) when he evaluated the case study of Hewlett-Packard Company with its product Ignite UX and how they developed a software focusing on UX design and its contextual evaluation. The company developed its final product, making different experiments and prototypes based on the reviews of its potential customers, including focus groups. The team that was developing the product was more confident to propose practical solutions, make drastic changes because, as a result of the UX evaluation, they had a clear picture of what are the needs of their customers. (ibid.)

Besides achieving success on the market, for the company, the result of this project revealed that developing a product based on UX evaluation helps not only the customer but also saves money. It allows a continuous and grounded progress in projects and helps the teams and workers to be motivated and have a clear vision about the concept they are developing; impacting in this way also the managerial sphere. (ibid.)

2.5 Theoretical Framework

Different models have been proposed to analyse and evaluate UX in different contexts. Nevertheless, most of them can be considered as simplistic because they only conceive the hedonic and pragmatic qualities in UX. That is the case of the model presented by Hassenzahl (2007) where he defines *"pragmatics refer to the product's perceived ability to support the achievement of "do-goals," such as "making a telephone call," "finding a book in an online bookstore," "setting-up a webpage." In contrast, hedonics refers to the product's perceived ability to support the achievement of the "be-goals," such as "being competent," "being related to others," "being special"* (10-14).

Similarly, Jetter and Gerken (2006, 110) proposed a model where hedonic qualities and pragmatic qualities are evaluated as parts of the same category; and variables concerning business model are named as "everyday operations," "marketing," and "branding". These are evaluated under the organisational values category. The interactions between them, the product, and the user will lead to an analysis of the overall experience. Even when this model integrates a business dimension into the context, both of the models fail to recognise societal or emotional variables as parts of UX evaluation process.

Additionally, the holistic model of UX purposed by Pallot and Pawar (2012) adopted different dimensions and experiences in order to have an understanding not only about UX experience in general but also to evaluate it through different perceptions as depicted in the figure below.

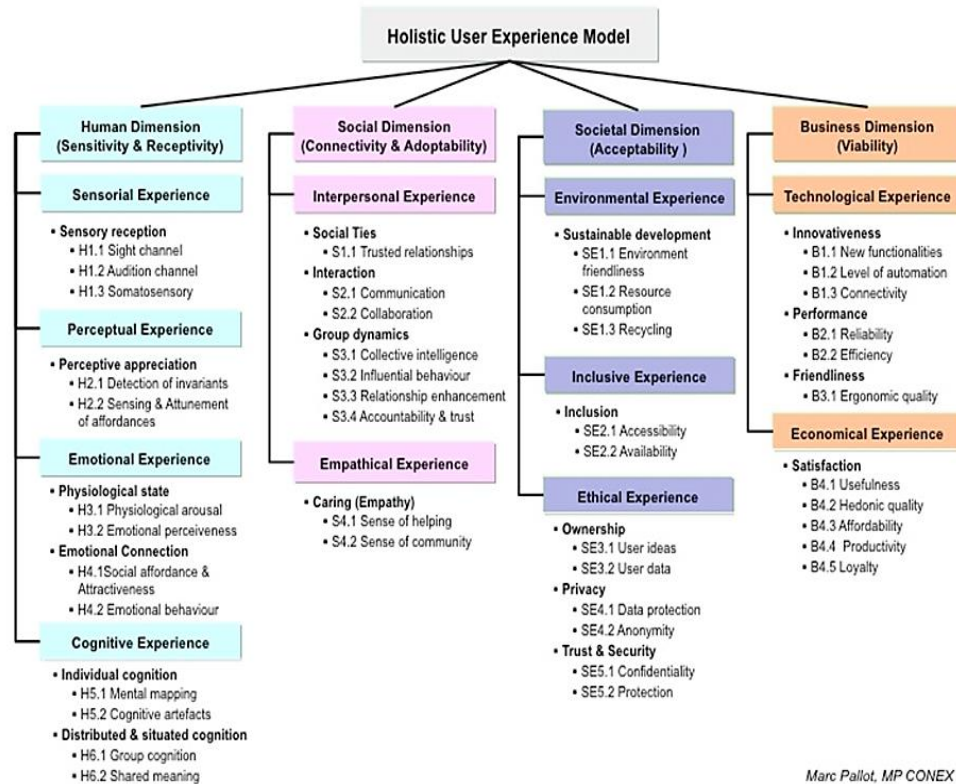


Figure 7. Holistic Model for UX (adapted from Pallot & Pawar 2012)

Pallot and Pawar (2012) mentioned that UX has various dimensions, types of experiences, elements of each dimension, and properties that are a result of different interactions between product and users. Besides, each dimension is broken down within different experiences in order to capture the perception of users towards UX (Krawczyk, Topolewski & Pallot 2017, 1).

Human dimension is composed of four types of experiences: sensorial, perceptual, emotional, and cognitive. In this dimension, the sensitivity and receptivity of the user are reviewed. This sphere analyses the user as an individual and avoids the environment context to some extent, for an intelligible appreciation of user behaviours.

Social dimension is composed of interpersonal and emphatical experience. In this dimension, the connectivity and adaptability are analysed. One relevant property in

this dimension is the variable "caring" due to it can represent a connection between the user and the product. Additionally, in this study, the property "collaboration" will be revised. It is defined as *"collective production (Evaluation: monitor Interaction patterns and frequency, action and production patterns, participation rate)"* (Pallot & Pawar 2012). This property belongs to the social interaction type of experience. It is one of the focal points the research due to the importance of collaboration in a class environment as a part of Jaxber use-case context in education.

Societal dimension is conformed by environmental, inclusive, and ethical experience. Seeks to appraise the external factors that can influence the individual perceptions and experiences of the user. A critical aspect in this dimension is the variable of "trust and security" due is essential for building a relationship with the user. (ibid.)

Business dimension, composed of technological experience that leads to a deep understanding of the technical aspects of the product and its capacities and economical experience; that has a relation with the post-purchase customer behaviour noted by the property B4.5 concerning to loyalty. In this research, both technological and economic experience will be revised, including the following elements and properties.

- Innovativeness: In this element, the property "new functionalities" or "novelty" is defined as "creativity expressed by innovative product/service based on IoT" (ibid., 11)
- Performance: Efficiency, *"in operating the IoT based product/service (Evaluation: measure the efficiency through the duration to perform a task)"* (ibid.,11)
- User-Friendliness: Ergonomic quality defined as *"optimisation of human effortless to operate the system"* (ibid., 11)
- Satisfaction: (a) Usefulness defined as "utility is a measure of relative satisfaction based on IoT product." (b) Enjoyment, hedonic quality defined as *"Subjective evaluation (pleasure, fun, cool, originality, innovativeness,*

engaging, appealing, desirability, comfortability, attractiveness)." (c)
 Productivity defined as an *"increase of efficiency through the use of technology."* (ibid., 11)

As has been discussed before, UX has to be conceived as an integral part of the evaluation of the aspects of the user as an individual, the context where the product is applied, the technical side of the product, and its economic impact for a business. The selected dimensions and elements of the holistic UX model are considered as its instantiation and serve as the theoretical framework for this research. The model has been developed as part of an EU funded Living Lab research project in 2009. In this project, there were 6 product/service cases, developed within different contexts and user profiles, to test and evaluate the model before its publication. (Pallot et al. 2014.)

3 Methodology

In order to answer the research question adequately, the methodology chapter addresses the question of how research should be conducted including the theoretical and philosophical assumptions and the implications for the methods adopted (Saunders et al. 2009, 674).

3.1 Research Context

Jaxber Mobile App has been applied in higher education systems, specifically Business Schools, in different course environments such as research and development, leadership skills, innovation management, and global product development. The applied dynamic consists of the use of the mobile app during the full semester courses (duration of 3 to 4 months).

The students are encouraged to complete assignments or a collective learning diary based on the needs of the lecturer of the course, where they can test the features of the app. For example, video capture and reproduction, user interface, design, among others. Once the course is completed, the students were asked to fill in a survey as feedback for improvements in the app. Due to this fact, there is no possibility to develop a longitudinal study over the same population; because the users eventually cannot repeat the same course twice in the degree programme and there is the discretion of the lecturer on whether to use or not the mobile app as a learning tool.

It is important to emphasise that because of the context of the courses and the higher school environment itself; the participants of the survey were familiar with the terms of UX and its properties. Therefore, their collaboration is significant in understanding the functionality of the app. Furthermore, the students were informed about the impartiality of the survey results, meaning that completing the survey about the app was not going to affect in any case their final grade in any of the courses under investigation.

After two years of collecting this information, there was a set of data comprised of the thoughts, reflections, and evaluations of the users of this app.

3.2 Research Design

The researcher used the design structure modelling purposed by Saunders et al. (2009,108).

3.2.1 Research Purpose

The purpose of this research is **decripto-explanatory** (Gatotoh, Gakuu, & Keiyoro 2017; Mokaya, Lovega, Wagoki, & Karanja 2013) in that the research project utilises the description of UX properties and the changes in their ratings between the year 2017 and 2018 and possible explanations behind the results in those two years.

3.2.2 Research Approach

The research uses an **abductive approach** (Dubois & Gadde 2002; Krupnik 2012) moving back and forth from theory to data and from data to theory in effect combining deduction and induction. The abductive approach, which, in term, can be tested through subsequent data collection. From the theoretical point of view, the abductive approach allows, wherever appropriate, the incorporation of the existing theory with the aim of possible theory modification or a new theory building.

In our case, the theoretical framework represented by the holistic UX model proposed by Pallot and Pawar (2012) is being used to capture UX data and analyse emerging themes and patterns regarding user experience of the Jaxber mobile app under investigation.

3.2.3 Methodological Choice

According to Schoonenboom and Johnson (2017), the goal of applying **mixed-method research** is to strengthen and expand the conclusions of the study. Quantitative studies can show results veridically; nevertheless, they have a weakness in revealing the specific reasons behind those results. In contrast, qualitative studies are able to provide context because of the nature of its data. (Krawczyk, Maslov, Topolewski, Pallot, Lehtosaari & Huotari 2019, 7.) Taking into consideration that it is the aim of this study to analyse customers perspectives and opinions towards Jaxber Mobile App as well as evaluating veridically UX properties, the Mixed-Method Research approach suits the goals of the present study.

Morse and Nieahous (2009) discussed that one of the most critical parts of developing mixed-methods research is to find a "point of interface," defined as the integration of the different qualitative and quantitative components of the study. Teddlie and Tashakkori (2009) argued that there are different integration strategies that can be implemented through the different stages of the research underlining

the data collection stage; nevertheless, this interface stage can be presented in analysis or results stages as well.

Additionally, Creswell and Clark (2011) analysed different primary integration stages for mixed methods outlining the possibility of developing an instrument with embedded types of data. Creswell, Plano, Gutmann, and Hanson (2003, 210) discussed previously a strategy for this approach named **Mixed Methods Concurrent Nested Strategy (MMCNS)** that in this study consists of a qualitative part embedded into the quantitative one. The details of the questionnaire instrument can be found in chapter 3.3.

3.2.4 Research Strategy (Methods)

In this research, a **survey** is selected as a method for qualitative and quantitative data collection. The survey instrument consists of a bipolar questionnaire (close-ended question) where respondents rated from 1 to 5 the level of the satisfaction towards a determined UX property and the qualitative question that aims to gather information about the specific reason of the rating (open-ended question). A more detailed description of the survey instrument can be found in chapter 3.3 regarding data collection.

3.2.5 Research Time Horizon

Furthermore, this is a **repeated-cross sectional** (Magnavita & Heponiemi 2012; Nacul, Lacerda, Pheby 2011) study where data was collected in two successive periods and can be evaluated from the perspective of possible changes occurring during the time. (UK Data Service 2015, 9). In this case, the researcher will evaluate cross-sectional information from the years 2017 and 2018, respectively.

3.3 Data Collection

The secondary data was obtained with permission from the company that develops Jaxber mobile app. The research represents a repeated cross-sectional study analysing two empirical data sets based on the same value dimensions of user experience (UX) evaluation instrument from the years 2017 and 2018. The user experience evaluation instrument is an instantiation of the holistic UX model representing a theoretical framework developed by Pallot and Pawar (2012).

Secondary Data

When considering a research study in the business field, usually primary data (collected by the researcher with the exact objectives for the research) needs to be collected. However, the use of secondary data (collected previously in different circumstances) is regarded as a powerful tool for answering entirely or partially a research question. (Saunders et al. 2009, 256). According to Vartanian (2010, 14), secondary data, in short words, can be defined as data that was collected in previous studies with different objectives but can be reused for answering new research questions.

Silva and Carneiro (2018, 3) discussed the opportunities that the use of secondary data can bring to develop further studies, understand events, or phenomena from different perspectives. Thus, while reviewing previous data, unforeseen findings can be discovered. In the same way, because of the available information and public databases on the internet, secondary data is a reliable shortcut for gathering the needed empirical evidence. (ibid.)

Cowton (1998, 425) outlined the use of secondary data for business studies and stated that independently of the availability, it is essential that the researcher is able to understand the context and purposes for what it was collected. Based on these findings, the researcher can decide whether to use or not a data set. Consequently, advanced abilities on the topic of study are required for correct data discernment. (ibid, 426.)

Russell (2001) remarked that one of the principal constraints that researchers may face while developing a study is time; accurately, those that require evaluation through time, for example, longitudinal studies or as is the case of this thesis, repeated cross-sectional studies. Therefore, the availability of secondary data is considered as an advantage, and eventually is the principal method to develop feasible results (40).

Various criticisms have been expressed towards the use of secondary data in academic research. Saunders et al. (2009) allege that there is not enough control about the developments of the instrument for gathering data as well as the null control in the quality of data (270). The researcher acknowledges the above mentioned shortcomings in the use of secondary data as a source of potential limitation of this study. Nevertheless, considering that the study is made in the context of a software company developing Jaxber mobile app and given that the secondary data was collected based on a survey instrument grounded in a theoretical framework elaborated over the years by a team of scholars (Pawar & Pallot 2012; Krawczyk et al. 2017; Topolewski, Lehtosaari, Krawczyk, Pallot, Maslov & Huotari 2019; Krawczyk et al. 2019), the assumption is that the potential limitations are outweighed by the value of immediate applicability of the results to future developments of the mobile app under investigation.

Survey Instrument evaluation

Different types of secondary data can be used in research: (a) Documentary, that consists of written materials like reports, journals, newspapers, or internal communications in a company or non-written materials like video and audio recordings. (b) Multisource, comprise of area-based information (government reports, books) and time-series based (industry statistics and reports). (c) Surveys, the most important types, are census because they are generated by the government and continuous regular surveys that are applied in the private sector mostly, internal processes of companies or marketing companies. (Saunders et al. 2009, 259).

The relevance of each one is not an ontological matter but depends on the degree compatibility between the source and the objectives of the research (Johnston 2014, 621). As mentioned before, the most common instrument for gathering information in commercial and public organisations are surveys. This research utilises two combined questionnaire-based surveys for collecting simultaneously quantitative and qualitative data regarding various value elements of Jaxber mobile app user experience. Hence, these data sets will be analysed in an attempt to answer the generic research question. Table 1 includes an example of one of the questions presented to the users.

Table 1. Example of question

Quantitative Part	Qualitative Part
Please rate the enjoyability of Jaxber app. Where (1) means not-enjoyable (2) mostly not-enjoyable, (3) almost enjoyable, (4) mostly enjoyable, and (5) enjoyable	Explain the reasons behind your rating of the enjoyability of Jaxber app.

The nature of the bipolar questionnaire is characterised by a continuum between two opposite endpoints. *"A central property of the bipolar scale is that it measures both the direction (side of the scale) and intensity (distance from the centre) of the respondent's position on the concept of interest"* (Lavrakas 2008).

Rating scales are considered among the most common methods for data collection in social sciences and serve as a technique that can capture data about abstract concepts for analysis and further evaluation (Menold & Bogner 2016). The critical factors to take into consideration in this instrument are (a) the categories, (b) the range of the question, and (c) the number repetitions. When analysed, the resulting information may help to understand the tendencies among the respondents. (Parducci 1983, 265.) In the case of this study, the "categories" are the properties

(value elements) for UX evaluation. The five-point scale of the measure in each question ranges from 1 to 5.

Different criticisms towards rating scale or bipolar questionnaires have raised over the years. The most relevant refers to the concept of range, if the respondent has a vast number of possible options, it can get confused, affecting the quality of the information gathered (Friedman & Amoo 1999, 117). There is also a discussion about what are the "exact" meanings of every category, and if the respondent can understand the question correctly (ibid. 118).

The above-mentioned shortcomings were addressed by the introduction of a simple to follow and understand by respondents five-point semantic scale. Therefore, the range of five options available for answering the question is sufficient for providing a clear understanding of what users think and feel towards Jaxber Mobile App.

Wadell (1995, 6) discussed the value of rating scales for evaluation of customer satisfaction and stated that the results provide insights about what is the current situation of a specific product or service; moreover, the critical information addresses the needs for improvement. At the same time, in order to obtain the missing information, the instrument has open-ended questions where it is possible for respondents to justify their ratings due to positive or negative experiences as well as offer suggestions for future improvements of the mobile app.

Regarding the population, it is a group for which the researcher intends to generalised the results of the study (Statistic Solutions 2019). According to Scheaffer, Mendenhall, and Lyman (2006, 8), the population is "a collection of elements about which we wish to make an inference." However, this study does not attempt to make generalisations about the entire population; instead, it addresses the user experience of Jaxber App in the context of higher education. The population of this research consists of students from higher education institutions in Finland and France. The age of respondents ranges between 18 to 29. Both genders have been

represented in the survey. All the participants had the opportunity to use the Jaxber Mobile App for four months.

According to Tailor (2005, 186), a sample is a subset of the population. The sampling technique used in this research was convenience sampling. Dörnyei (2007, 99) claimed that the populations that are selected with this technique are geographically close, available, accessible, and are relevant to the topic of the study; therefore, they constitute an advantage in terms of resources for the researcher, making the study more feasible. In the case of this research, the sample selected is formed by the users of the Jaxber App that were available to reflect on their experiences after using the App.

3.4 Data Analysis

Data Analysis is the set of techniques, procedures used to describe, categorise, illustrate data in order to generate conclusions and meanings (Shamoo & Resnik 2003). There are different methods that can be applied within this stage, and these depend on the type of data collected by the researcher, qualitative or quantitative (Saunders et al. 2009, 480). Patton (1987) commented that in the data analysis stage, the researcher is able to identify and link the data with the research question in order to find valuable results. Because the research type chosen is Mixed Methods, the researcher will employ different techniques depending on the nature of the data.

3.4.1 Quantitative Analysis

The main objective of the quantitative analysis is to test statically if there is a difference between the means of both waves in 2017 and 2018. Each wave consists of seven variables measured at a 5-point Likert scale. There is no agreement among researchers about the application of ANOVA analysis to Likert scale data, for which assumptions of ANOVA are usually violated. Some authors claim that ANOVA is robust against the violation of assumptions so it can be safely applied (e.g., Carifio &

Perla 2008; Norman 2010). Others point to a need for non-parametric tests to be applied (e.g., Vigderhous 1977; Kuzon, Urbanche & McCabe 1996; Jamieson, 2004). The program used for developing this study was SPSS (Statistical Package for the Social Sciences) because it was specifically developed for inferential statistical analysis related to social sciences. **All statistical tests are done at significance level 0.05.**

Thus, the specific process followed by the researcher is:

- a. Data Preparation: In order to prepare the data for its use in the analysis stage.
- b. Descriptive statistics display: There are two main objectives to perform descriptive statistics. One is to highlight the potential relationship between variables, and the second is to find basic information about variables in a dataset. The descriptive statistical display helps the researcher to simplify large amounts of data in an aggregated way, considering that in a study, there are numerous variables that are to be measured. (Sharma 2019, 4-5.)
- c. Normality Test to check ANOVA assumption: Even though Geary (1947) commented that "*normality is a myth and the existence and application of samples with normal distribution is slight*," many scholars, including Das (2016) advocate to test the normality of the sample distribution. For that reason, Kolmogorov-Smirnov and Shapiro-Wilk tests displayed by SPSS are applied.
- d. Variance Homogeneity Test to check ANOVA assumption: Gastwirth, Gel, and Miao (2010) stated that before comparing means in a specific data set is necessary to check that the samples have a common variance. Therefore, the Levene test was applied to establish the homogeneity of the variance.
- e. ANOVA Analysis: Analysis of variance (ANOVA) is a statistical tool used to detect differences between experimental group means (Sawyer 2009). Because the data samples were collected within two waves from two different groups, the ANOVA analysis was applied.
- f. Non-parametric Kruskal-Wallis Test: Is the non-parametric analogue of a one-way ANOVA, which does not make assumptions about normality (Kruskal &

Wallis 1952) and variance homogeneity. Because of differences in normality in the samples, this test is applied.

- g. Display Results: The researcher exported the results in a compatible format for this thesis. See chapter 4.

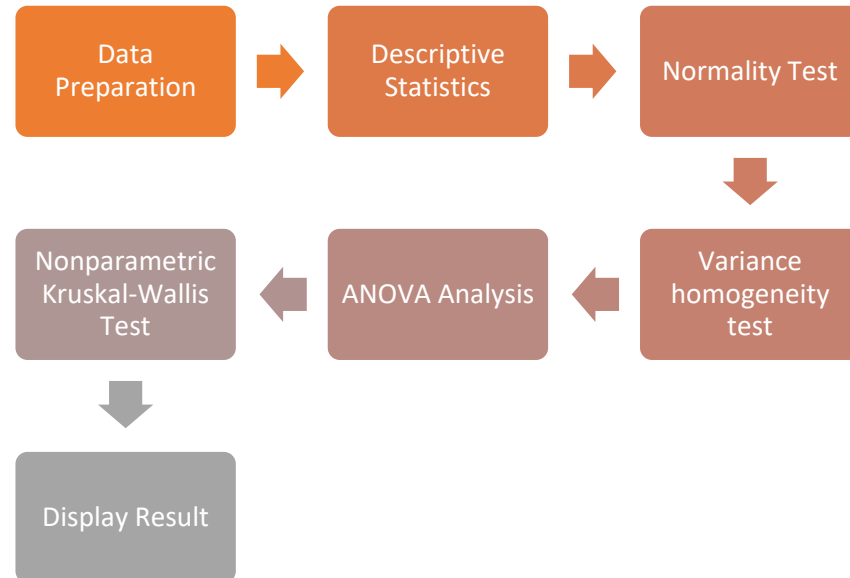


Figure 8. Quantitative Data Analysis Process

3.4.2 Qualitative Analysis

Based on the research question and the objectives of this research, the chosen techniques for processing qualitative data are sentiment analysis and the cloud of terms.

Sentiment Analysis is a technique that focuses on extracting subjective information from language expressions (Liu 2009). According to Akshi and Teeja (20012, 1), in recent years, companies tend to conduct surveys among the general public or its specific customers or users to learn about their perceptions towards the product or services being offered. Rambocas and Gama (2013) noted that by applying sentiment analysis, it is possible to learn about customer feelings and attitudes regardless of the data volume and structure. This technique is characterised by the polarity of its

results; those can be either positive or negative. Moreover, contemporary studies have implemented the possibility of a "neutral" perception. (Akshi & Teeja 2012, 3.) In order to assess the sentiment perception of the users of the Jaxber App, the researcher decided to apply the methodology proposed by Rambocas and Gama (2012).



Figure 9. Sentiment Analysis Methodology (adapted from Rambocas & Gama 2012)

- a. Data Collection: Stage where the researcher finds the data that will be processed
- b. Text Preparation: The data used in this evaluation constitutes the justifications to the ratings that the users gave in the UX questionnaire about the Jaxber App. It is essential to find if there is a correlation between the rating and the justification in order to process valid data. For example, if the participant rated the property "Enjoyability" with 5 points representing the maximum value with associated meaning that the app is enjoyable and at the same time in the rating justification explained: "I consider this app is hard to understand, not enjoyable" there is a contradiction that may indicate not only a lack of correlation but possible issues with data quality. Such data were omitted in the analysis stage as it was not possible to determine whether the quantitative or the qualitative part of the questionnaire was accurately decoded (understood) by the respondent.
- c. Sentiment Detection: The researcher interpreted the different answers in order to determine the feelings behind the presented words. This represents a process that might be highly subjective and, as such, become one of the limitations of the study. There are different software's available that can process this type of data, for example, Lexalytics, IBM Watson, MeaningCloud, among others. Furthermore, the researcher opted to do this

process manually because, for the time being, human intellect is still superior and more exact than existing artificial intelligence solutions in determining if a comment is positive, negative, or neutral based on the context of the research and not only the grammar employed in the answers.

- d. Sentiment Classification: In this phase, the researcher decided to which category of sentiment the comments belonged. There are three different categories to be considered: positive, negative, and neutral. In order to facilitate the output process, the researcher gave symbolic values to each category being (1) positive, (- 1) negative, and (0) neutral.
- e. Output presentation: In order to display results comprehensively, the researcher calculated the percentages of the total answers of each property to observe which sentiment is more predominant. See chapter 4 for specific details.

Additionally, a second technique is applied in the analysis of the qualitative data, the cloud of terms. Havley and Keane (2007), define this technique as *"visual presentations of a set of words, typically a set of tags, in which attributes of the text such as size, weight or color can be used to represent features (e.g., frequency) of the associated terms."*

Depaolo and Wilkinson (2014), noted that the use of cloud of terms is an effective tool for honing the most important concepts from a set of qualitative data and finding relationships among them and the research in question. Mckee (2014), articulated it is an important communicational tool for the reader because it is visually appealing in comparison with a table as well as self-explanatory.

For developing this technique, the researcher used a specific software named NVivo 11 Pro, because it is a program that is designed specifically for data analysis in qualitative studies. The software automatically deletes from the results words related to articles, pronouns, or prepositions (e.g., me, by, for, the, at) and only

presents relevant concepts for the research. The specific steps followed by the researcher are:

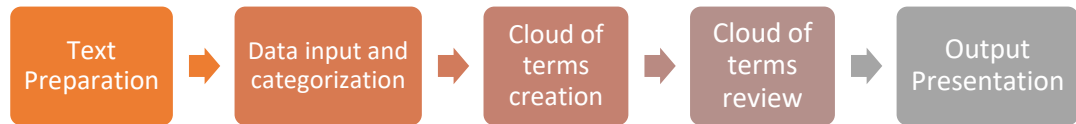


Figure 10. Cloud of terms Methodology

- a. Text preparation: The researcher prepares the data in a compatible format for the software NVivo 11
- b. Data input and categorisation: The researcher uploads the data into the program and classifies the text for each UX property explored (e.g., enjoyability, usefulness, user-friendliness).
- c. Cloud of terms creation: Once the data is ready to be processed by the program, the researcher runs a query in which the results are presented in the form of a cloud of terms. The settings applied for each cloud were a maximum of 70 words per cloud, and each concept should have been repeated a minimum of five times in the data to be considered.
- d. Cloud of terms review: Even when the software automatically eliminates terms that are not useful for further analysis, the researcher evaluated the results of NVivo and decided to eliminate additional terms that were not useful and fell in the categories of prepositions and pronouns.
- e. Output presentation: The researcher exported the results in a compatible format and included them in chapter 4.

3.5 Verification of findings

3.5.1 Quantitative verification of findings

Validity

According to Zohrabi (2013), internal validity is concerned with the congruence of the research findings and the real scenarios where these would be applied. Hence, it evaluates whether the researcher is observing or measuring the right phenomena or data according to its research question. (258.) Merriam (1998) suggested that triangulation of data can strengthen validity because analysing the information with different techniques can confirm findings.

There are two tests applied, ANOVA and nonparametric Kruskal-Wallis. These different techniques provided insights from different perspectives from the same data, which gave the researcher a clear understanding of the facts. Finally, there was the triangulation of results (see chapter 4.3) where the different techniques for qualitative and quantitative data were joined for explanations concluding that the results are complementary and not contradictory to each other.

External validity concerns the extent of the applicability of the findings to other settings or generalisation of the results (Zohrabi 2013, 259). The researcher considers that the results of this thesis are only applicable to the context of the Jaxber App, because different factors for UX evaluation may vary on each product or service. Hence, the researcher does not pretend to generalise the results to any extent.

Reliability

It is defined as "the extent to which your data collection techniques or analysis procedures will yield consistent findings" (Saunders et al. 2009, 156). Thus reliability refers to the quality of the results. Zohrabi (2013, 259), suggested that for increasing the reliability of research, the researcher needs to explain explicitly the processes used. In the next paragraphs, these processes are described.

In the case of this thesis, the dominant source used is secondary and belongs to the organisation Jaxber. For ensuring the reliability of the questionnaire, the researcher evaluated the objectives for what it was collected and its theoretical framework, both suited the purposes of this study.

The researcher checked the assumptions required for applying ANOVA test, like normality and variance homogeneity concluding that the standard assumptions were violated. Hence, the nonparametric Kruskal-Wallis test was used obtaining the same results in both tests.

Objectivity

Saunders et al. (2009, 157) discussed that the researcher's error or bias is more probable to occur when multiple individuals are carrying the same research because there can be different interpretations of the data, and the results tend to be unreliable. However, in the case of this research, there is one individual that has conducted the study; thus, bias is minimised. The researcher has justified the choices about the methods and techniques applied appropriately.

However, the researcher admits that it is possible to find subjectivity in her thesis because of her recent knowledge of the technical information about UX and UX evaluation. Additionally, her lack of experience in research as being a third-year bachelor's student at the time this study was written can be an incidental factor. Moreover, there was an exhaustive self-preparation and investigation about the topic in general, to develop this thesis and minimise the impact of bias.

3.5.2 Qualitative verification of findings

Credibility and Transferability

According to Trochim and Donnelly (2008), the credibility establishes if the results are credible from the participants perspective; since qualitative research focuses on describing phenomena from the participant's view. Eriksson and Kovalainen (2008) noted that when evaluating credibility, it is vital that the researcher is familiar with the topic, and the data should be sufficient for the researcher's claims.

Before the implementation of the study, the author immersed herself with information concerning UX, UX evaluation, and the different methodologies applied in this research to minimise the bias. There are two techniques applied for qualitative analysis, sentiment analysis and the cloud of terms. These allowed the researcher to gather clear insights about the explicit opinions and thoughts of the users of the Jaxber App.

Additionally, the sample for the year 2017 has 98 answers, and the sample of 2018 has 100 answers, which means that the researcher in total gather 198 answers in total. The researcher considers this is a sufficient number of answers to proceed with an evaluation of UX experience of the Jaxber app.

Transferability refers to the extent to which the results intended to be generalised. (Trochim & Donnelly 2008). The researcher does not intend to generalise the results as this study refers only to the Jaxber app. The results of competitive advantage and UX evaluation depend on the context they are applied.

Dependability

According to Eriksson and Kovalainen (2008), dependability evaluates if the researcher has provided sufficient information concerning the research process to the reader. This concept is as well based on the assumption of repeatability and

whether the same results would be obtained if the same context is observed twice (Trochim & Donnelly 2008).

The researcher applied sentiment analysis and the cloud of terms technique. When processing the data in sentiment analysis, the researcher opted for a manual approach instead of using software to determine the sentiment of the opinions of the users. The reason was that most of the software analyse the feelings based on the grammatical context of the sentence and not take into consideration the background of the answer. Additionally, the researcher checked the correlation of the responses in the qualitative and quantitative parts of the questionnaire. (see details in 3.4.1)

Concerning the cloud of terms, the researcher used the software named NVivo 11 Pro as a tool for qualitative data analysis. The program eliminated most of the words that were not useful for the clouds automatically. Still, the researcher also checked manually that words like prepositions or pronouns were not present, but only relevant concepts for the study

Additionally, this is a repeated cross-sectional study, which by nature it revises a context twice.

Confirmability

According to Trochim and Donnelly (2008), confirmability refers to the extent to which a third person can corroborate the study and its results. It also refers to link the data and making interpretations that can be easily understood by the reader (Eriksson & Kovalainen 2008). The researcher applied two techniques to analyse the qualitative data and two statistic tests to corroborate the results. Furthermore, this information gathered from different perspectives gave a clear understanding of the context to the researcher, as well as allowed the triangulation of results; concluding that these are complementary to each other.

4 Results

In this chapter, the results are divided into two sections. Qualitative results will reveal the information concerning the sentiment of the users as well as the main terms used to describe them and quantitative results related to information about the statistical tests taken in this study.

4.1 Quantitative Results

As a reminder for the reader, the main objective is to compare means between two waves of answers. Each wave consists of seven variables measured at a 5-point Likert scale. **All the statistical tests presented in this chapter have a significance level of 0.05.**

For gathering the first insights of both data sets, descriptive statistics are displayed (See table 4). In the table, it is possible to observe each UX selected property for this study and the number of total answers (N), the mean, the standard deviation, and the standard error of the mean for both years 2017 and 2018. These descriptive measures were chosen because they are relevant for the subsequent inferential statistics tests carried on this thesis as they are ANOVA and Nonparametric Kruskal-Wallis Test.

Table 2. Descriptive Statistics from 2017 and 2018

Group Statistics					
	Year	N	Mean	Std. Deviation	Std. Error Mean
Usefulness	2017	98	3.47	1.076	.109
	2018	100	2.99	1.193	.119
Collaborativeness	2017	98	3.41	1.092	.110
	2018	100	3.12	1.249	.125
Productiveness	2017	98	3.02	.908	.092
	2018	100	3.62	1.332	.133
Novelty	2017	98	3.90	.947	.096

	2018	100	3.27	1.362	.136
Efficiency	2017	98	3.05	1.019	.103
	2018	100	3.09	1.240	.124
User-Friendliness	2017	98	3.00	1.167	.118
	2018	100	2.68	1.317	.132
Enjoyability	2017	98	2.67	1.082	.109
	2018	100	2.62	1.262	.126

Testing assumptions of ANOVA

According to Das (2016), before testing ANOVA is required to verify the normality of the sample. Hence the statistical test Kolmogorov-Smirnov and Shapiro-Wilk are displayed.

Normality Test Hypothesis

H0: Variable has normal distribution

H1: Variable does not have normal distribution

Table 3. Tests of Normality

Tests of Normality							
	Kolmogorov-Smirnov ^a			Shapiro-Wilk			Result
	Statistic	df	Sig.	Statistic	df	Sig.	
Usefulness	.167	198	.000	.914	198	.000	Reject H0
Collaborativeness	.178	198	.000	.911	198	.000	Reject H0
Productiveness	.204	198	.000	.888	198	.000	Reject H0
Novelty	.175	198	.000	.882	198	.000	Reject H0
Efficiency	.178	198	.000	.914	198	.000	Reject H0
User-Friendliness	.171	198	.000	.905	198	.000	Reject H0
Enjoyability	.179	198	.000	.904	198	.000	Reject H0
a. Lilliefors Significance Correction							

Table 5 shows the results of the tests; none of the variables follow the normal distribution. As the significance for all variables is 0.000 these values are below 0.05,

which was established as the significance level. Thus, H₀ is rejected for all the properties.

Variance homogeneity test

Gastwirth, Gel, and Miao (2010) stated that for testing ANOVA is a requisite to test the variance homogeneity. The test Levene Statistic is displayed.

Hypothesis

H₀: Variances for different waves are equal

H₁: Variances for different waves are not equal

Table 4. Test of Homogeneity of Variances

Test of Homogeneity of Variances						
		Levene Statistic	df1	df2	Sig.	
Usefulness	Based on Mean	.124	1	196	.725	Retain H ₀
	Based on Median	.224	1	196	.636	Retain H ₀
	Based on Median and with adjusted df	.224	1	194.269	.636	Retain H ₀
	Based on trimmed mean	.142	1	196	.707	Retain H ₀
Collaborativeness	Based on Mean	.909	1	196	.341	Retain H ₀
	Based on Median	.499	1	196	.481	Retain H ₀
	Based on Median and with adjusted df	.499	1	194.270	.481	Retain H ₀
	Based on trimmed mean	1.023	1	196	.313	Retain H ₀
Productiveness	Based on Mean	14.659	1	196	.000	Reject H ₀
	Based on Median	11.485	1	196	.001	Reject H ₀
	Based on Median and with adjusted df	11.485	1	175.008	.001	Reject H ₀
	Based on trimmed mean	15.290	1	196	.000	Reject H ₀
Novelty	Based on Mean	20.394	1	196	.000	Reject H ₀
	Based on Median	15.404	1	196	.000	Reject H ₀
	Based on Median and with adjusted df	15.404	1	182.085	.000	Reject H ₀
	Based on trimmed mean	22.048	1	196	.000	Reject H ₀
Efficiency	Based on Mean	8.767	1	196	.003	Reject H ₀
	Based on Median	8.431	1	196	.004	Reject H ₀
	Based on Median and with adjusted df	8.431	1	195.990	.004	Reject H ₀
	Based on trimmed mean	8.795	1	196	.003	Reject H ₀
User-Friendliness	Based on Mean	5.140	1	196	.024	Reject H ₀

	Based on Median	4.084	1	196	.045	Reject H0
	Based on Median and with adjusted df	4.084	1	195.848	.045	Reject H0
	Based on trimmed mean	5.211	1	196	.024	Reject H0
Enjoyability	Based on Mean	3.249	1	196	.073	Retain H0
	Based on Median	5.468	1	196	.020	Reject H0
	Based on Median and with adjusted df	5.468	1	193.001	.020	Reject H0
	Based on trimmed mean	3.124	1	196	.079	Retain H0

According to the results in table 6, variance equality can be assumed for: Usefulness, Collaborativeness, and possibly for Enjoyability (different results for the various tests). It is not conceivable to assume variance equality for Productiveness, Novelty, Efficiency, and User-Friendliness.

Considering that the variables do not follow the normal distribution and do not account for variance homogeneity, the researcher concludes that assumptions of ANOVA are violated. Therefore, ANOVA analysis may not produce reliable results. The researcher decides to apply both ANOVA and statistically less powerful but robust nonparametric Kruskal-Wallis Test to compare means.

Testing for mean differences

ANOVA analysis

H0: Means for different waves are equal

H1: Means for different waves are not equal

Table 5. ANOVA Analysis

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Usefulness	Between Groups	11.375	1	11.375	8.798	.003
	Within Groups	253.398	196	1.293		
	Total	264.773	197			
Collaborativeness	Between Groups	4.110	1	4.110	2.981	.086

	Within Groups	270.233	196	1.379		
	Total	274.343	197			
Productiveness	Between Groups	17.794	1	17.794	13.649	.000
	Within Groups	255.519	196	1.304		
	Total	273.313	197			
Novelty	Between Groups	19.517	1	19.517	14.132	.000
	Within Groups	270.690	196	1.381		
	Total	290.207	197			
Efficiency	Between Groups	.075	1	.075	.058	.809
	Within Groups	252.935	196	1.290		
	Total	253.010	197			
User-Friendliness	Between Groups	5.068	1	5.068	3.270	.072
	Within Groups	303.760	196	1.550		
	Total	308.828	197			
Enjoyability	Between Groups	.142	1	.142	.102	.749
	Within Groups	271.111	196	1.383		
	Total	271.253	197			

Table 6 shows the results of the test ANOVA wherein the properties Usefulness, Productiveness, and Novelty reject the null hypothesis meaning that means for both waves are not equal. In contrast, for Collaborativeness, Efficiency, User-Friendliness, and Enjoyability, the null hypothesis is accepted.

Nonparametric Kruskal-Wallis Test

H0: Means for different waves are equal

H1: Means for different waves are not equal

Table 6. Nonparametric Kruskal-Wallis Test Hypothesis Test Summary

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Usefulness is the same across categories of Year	Independent-Samples Kruskal – Wallis Test	.003	Reject the null hypothesis
2	The distribution of Collaborativeness is the	Independent-Samples Kruskal – Wallis Test	.082	Retain the null hypothesis

	same across categories of Year			
3	The distribution of Productiveness is the same across categories of Year	Independent-Samples Kruskal – Wallis Test	.001	Reject the null hypothesis
4	The distribution of Novelty is the same across categories of Year	Independent-Samples Kruskal – Wallis Test	.001	Reject the null hypothesis
5	The distribution of Efficiency is the same across categories of Year	Independent-Samples Kruskal – Wallis Test	.739	Retain the null hypothesis
6	The distribution of User - Friendliness is the same across categories of Year	Independent-Samples Kruskal – Wallis Test	.058	Retain the null hypothesis
7	The distribution of Enjoyability is the same across categories of Year	Independent-Samples Kruskal – Wallis Test	.482	Retain the null hypothesis

Summary of Quantitative Results

Both approaches, ANOVA and non-parametric Kruskal-Wallis test, give the same results. Mean assessment of Collaborativeness, Efficiency, User-Friendliness, and Enjoyability did not change over time, while mean assessment of Usefulness, Productiveness, and Novelty did change over time. Usefulness and Novelty were perceived significantly worse (given lower scores) in 2018 comparing to 2017, while Productiveness was perceived significantly better (higher score). (See table 9)

Table 7. Summary results for ANOVA and non-parametric test

	ANOVA		Kruskal-Wallis Test	
	Significance	Decision	Significance	Decision
Usefulness	.003	Reject H0	0.003	Reject H0
Collaborativeness	.086	Retain H0	0.082	Retain H0
Productiveness	.000	Reject H0	0.001	Reject H0
Novelty	.000	Reject H0	0.001	Reject H0
Efficiency	.809	Retain H0	0.739	Retain H0
User-Friendliness	.072	Retain H0	0.058	Retain H0
Enjoyability	.749	Retain H0	0.482	Retain H0

4.2 Qualitative Results

4.2.1 Sentiment Analysis

In general, the results of sentiment analysis from the users towards the Jaxber App is positive. The participants could state a positive, negative, or neutral opinion. The majority opted for picking either the positive or negative option. Thus the neutral option had the smallest number of answers in both years, 2017 and 2018.

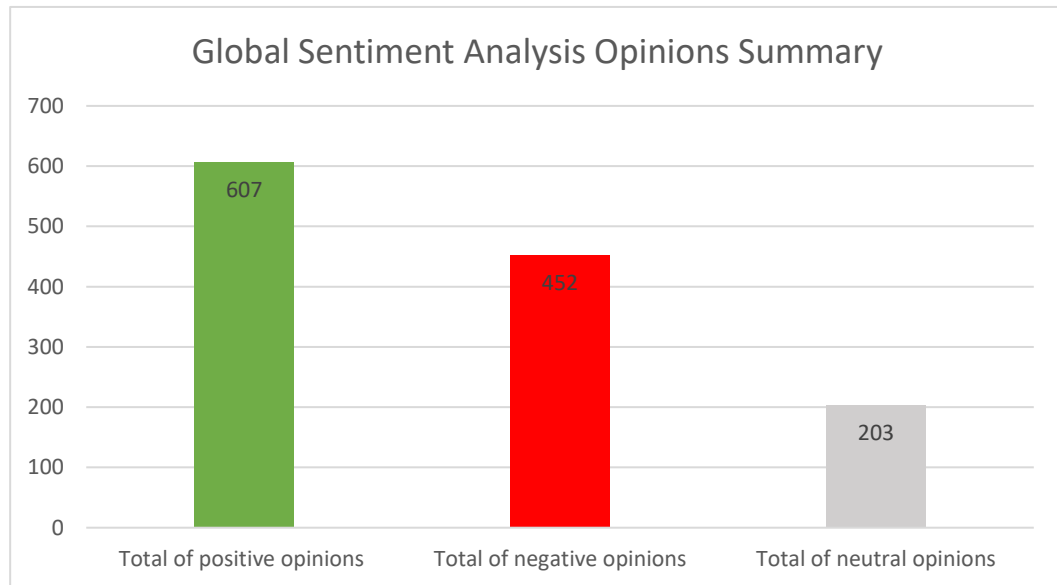


Figure 11. Summary of Responses of Sentiment Analysis

Figure 11 shows that a total of 607 opinions were positive, the same that represents 48.10% of the total sample that is composed of 1262 answers. There are 452 negative opinions that represent 35.82% of the total sample, and finally, there are 203 neutral opinions that represent 16.09% of the total sample. These insights are a general view of both data waves combined.

The year 2017

In table No. 2 it is possible to observe that the number of responses in the total column is different for each property, it is a consequence of the reduction because it is necessary to check that there is a correlation between both parts of the

questionnaire, qualitative and quantitative. In order to make the results comparable between the properties, all were transformed into percentages. (See chapter 3.4.1)

Table 8. Sentiment Analysis Data for 2017

UX Property	Number of opinions after correlation				Percentages of total sample per property		
	Negative	Neutral	Positive	Total	Negative	Neutral	Positive
Enjoyability	36	27	35	98	36%	28%	36%
Usefulness	19	17	58	94	20%	18%	62%
Productivity	28	25	33	86	33%	29%	38%
User-Friendliness	47	19	30	96	49%	20%	31%
Efficiency	31	21	38	90	34%	23%	43%
Novelty	6	17	69	92	7%	18%	75%
Collaboration	21	14	53	88	24%	16%	60%

In the year 2017, the property with the highest number of positive opinions was “Novelty” with 75% of acceptance from users, followed by “Usefulness” that has a 62% of its total sample. On the other hand, the property with the highest number of negative opinions was “User- Friendliness” with 49%. Subsequently, there is “Enjoyability,” with 36% of negative opinions. Lastly, “Enjoyability” is the property with the highest percentage of neutral opinion, with 29% of the total sample. (See figure 12)

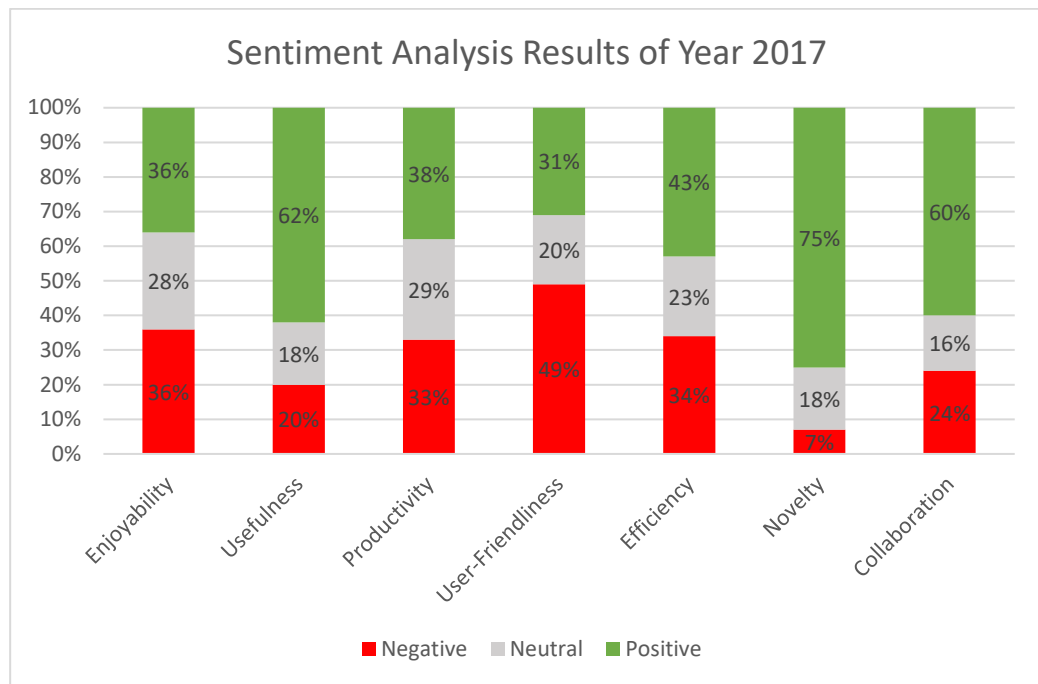


Figure 12. Sentiment Analysis Results of the Year 2017

The year 2018

The same procedure applied for the year 2017 was replicated in the year 2018. Table 3 shows the number of opinions after correlation, and the percentages of each property in comparison with the total sample.

Table 9. Sentiment Analysis Data for 2018

UX Property	Number of opinions after correlation				Percentages of total sample per property		
	Negative	Neutral	Positive	Total	Negative	Neutral	Positive
Enjoyability	43	11	33	87	49%	13%	38%
Usefulness	43	10	41	94	45%	11%	44%
Productivity	21	4	63	88	23%	5%	72%
User-Friendliness	57	10	25	92	62%	11%	27%
Efficiency	33	12	45	90	37%	13%	50%
Novelty	32	8	51	91	35%	9%	56%
Collaboration	35	8	33	76	46%	11%	43%

In the year 2018, the property with the highest percentage of positive opinions is “Productivity” with 72%, followed by “Efficiency” that has 50% of positive opinions. Moreover, the property with the highest number of negative opinions is “User-Friendliness” with 62% of its total sample; the second worse is “Enjoyability.” There are two properties with 13% of neutral opinions, “Efficiency” and “Enjoyability.” (See figure 13)

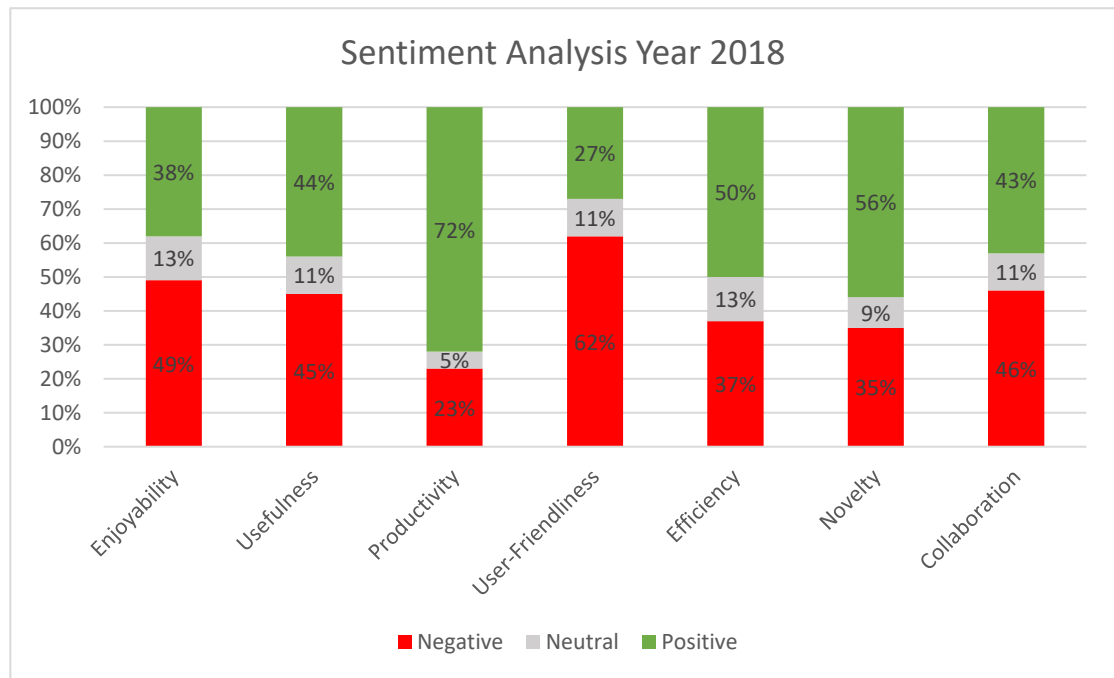


Figure 13. Sentiment Analysis Results of Year 2018

Comparison between 2017 and 2018

In figure 14, the variations of sentiment analysis opinions from both years are displayed. For example, the property with the most positive opinions in 2017 is novelty, whereas in 2018 is productivity. On the other hand, the property with the most negative opinions in both years is user-friendliness. It is important to emphasize that in the case of neutral opinions, the percentage in all the studied properties is reduced. Therefore respondents decided to situate their opinion either on positive or negative sides.

Properties that increased its positive opinions percentage are enjoyability, productivity, and efficiency. Properties that increased its percentage in negative opinions are enjoyability, usefulness, user-friendliness, efficiency, novelty, and collaboration. It can be noted that in the properties enjoyability and efficiency, both positive and negative opinions raise, and neutral opinions decrease (See figure 14).

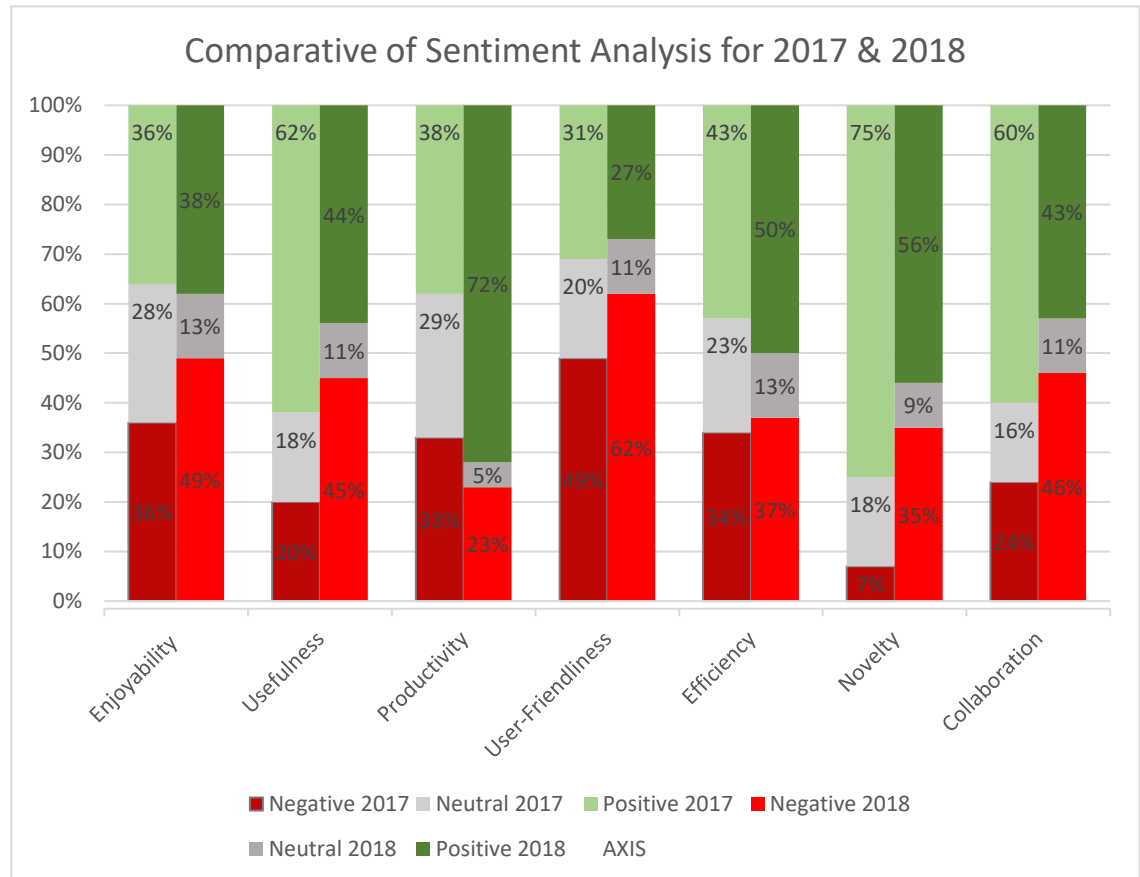


Figure 14. Comparative Results of Sentiment Analysis for years 2017 and 2018

4.2.2 Clouds of Terms

There is a total of seven clouds of terms corresponding to each of the selected properties for this research. The data used for its creation is from both waves. Each cloud presents observations of its content concerning the context of the study. These also represent the possible sources of competitive advantage because the clouds compile and summarize the comments related to the experience of the end-users,

Usefulness

The main two terms that constitute this cloud are “useful” and “app”; therefore, in the user’s opinion, in general, the app is useful. Moreover, some terms can as well lead to aspects for improvement related to this property, for example, the terms “problems”, “hard” and “useless”. Other words underline the positive aspects of the app like “tool”, “easy”, “share” and “diaries” (See figure 16).

The comments provided by the users emphasized the explicit use of the app, and they consider that it is a tool for learning purposes because it is possible to share content with the class as well as to keep learning diaries if needed. It is feasible as well to save information during the period of the courses. For example: *“Good way to do schoolwork on the phone”, “There are a lot of different forms of uploading your response to assignments”, “Easy way of gathering all the information at the same time”*.



Figure 16. Cloud of terms of the UX property Enjoyability

Some users consider that the concept is new, but the design of the app should be improved to become a novel app, the terms related are “old”, “fashioned”, “design” and “style”. Some concepts describe the context where the app has been used, for example, “studying”, “work”, “students”, “information,” and “collective.” Some of the users consider the app as novel because precisely in the context of higher education, they have not used an app for this purpose, and Jaxber was its first experience. The user’s comments were: *“The design is not the best”, “Old Design, not user- friendly”, “It has bad colour”* (See figure 20).



Figure 20. Cloud of terms of the UX property Novelty

Collaboration

The distribution of the terms in this cloud is clearly wider than in the previous cases. Nevertheless, the words that protrude are “work”, “app”, “collaboration” and “people”. The users stressed the way that the app facilitates communication with the class in a virtual environment where it is possible to share comments and create campaigns. *“You can help each other”, “We can communicate with other users”, “Good for sharing content”*.

The terms that support the collaborativeness in the app are “community”, “sharing”. “communication”, “students”, “comments”, “share”, “access,” and “facilitates”. In this property, the users limited their opinions to the existent features of the app but did not specify possible improvements or problems. *“Nice chance to share others posts”, “We can share a lot, and you can help and support others”* (See figure 21).



Figure 21. Cloud of terms of the UX property Collaboration

4.3 Triangulation of Results

Triangulation in research is a term used to describe that different methods or techniques are used (Heale & Forbes 2013). Because this is mixed-methods research, there are three techniques applied: sentiment analysis and the cloud of terms for qualitative data and ANOVA analysis for quantitative data. Morse and Nieahous (2009) explained that one critical part in mixed-methods research is to find the “point of interference” where both of the results of the techniques complement each other. In this section, the results from different perspectives will be presented.

Usefulness

Based on both statistical test's ANOVA and non-parametric Kruskal-Wallis Test, this property is considered significantly worse because of the lower scores recorded in 2018. In the same line, the results of sentiment analysis evidence that in the year of 2017, the user's positive opinion was 62%, whereas, in 2018, the positive opinion was 44%, meaning that there was a decrease of the -18%.

The cloud of terms of this property presented most essential opinions from the user's perspective, wherein general, they consider the Jaxber App as a useful app, and in the same way, expressed that there are often problems presented while using the app which makes the experience hard.

Productiveness

In this property, the statistical tests revealed that it is considered statistically better, because of the higher scores recorded compared to 2017. In the same line, the sentiment analysis results show that there is a significant improvement; in the year 2017, positive opinions represented 38%, whereas, in 2018, the positive opinions were 72%, there was an increase of 44%.

The cloud of terms of this property revealed that some users consider the app is more productive compared to the approach of using paper for class activities in higher education environments. This perspective was associated as well with environmentalists' values that expressed is better to save paper for nature, when there is the possibility to use apps like Jaxber. It also expressed that there are technical problems that slow down the speed of the capacity of processing data of the app. Additionally mentioned that a desktop version of the app would add more value for the future.

Novelty

Statistically, this property is considered as significantly worse based on the variation of lower scores achieved in 2018. The sentiment analysis reveals similar results

because, in 2017, the percentage of positive opinions was 75%, whereas, in the year of 2018, the percentage of positive opinions is 56%, there is a decrease of 19%.

The cloud of terms shows that, in general, the users consider that it is a new app because of the concept and the functionalities that have. Nevertheless, the users expressed that the design and style should be updated to match the concept of “novel” holistically.

Collaborativeness

There is not a statically observed change in comparison to the previous properties. Nevertheless, there is still a correlation between qualitative techniques. For example, sentiment analysis revealed that in 2017, 60% of the users considered that the app incentives collaboration, and in 2018 this percentage reduced to 43%. The cloud of terms of this app shows different terms, such as sharing, community, comments, and facilitates collaboration. This percentage may decrease because of the technical problems the app presents while processing content.

Efficiency

There are not statically observed changes for this property. The results for sentiment analysis show that there is a variation in positive opinions from 43% in 2017 to 50% in 2018. Moreover, the information from the cloud of terms explained that the majority of the recorded problems are associated with the interface. The explicit expressions from the users were *“the app is slow”* and *“has software errors”*.

User-Friendliness

There are not statically observed changes for this property. Furthermore, both the qualitative techniques note negative comments from the user's point of view. For example, the sentiment analysis shows 49% of negative opinions in 2017 and 62% in 2018; it is an increase of 13% on negative opinions. The cloud of terms shows that users consider that the app is complicated to use and hard to understand.

Enjoyability

There are not statically observed changes for this property. The results of sentiment analysis revealed that the positive opinions in 2017 represented 36% and in 2018 the 38%. The cloud of terms shows negative comments as well, for example, the main problems that affect the enjoyment of the app are ascribed to the interface, speed on processing data, and software errors that are present regularly in the use of the app.

5 Discussion

This study was carried to explore which of the selected UX properties have changed over the years 2017 and 2018 based on the Holistic Model for UX as a theoretical framework (Pallot & Pawar 2012). The Mixed Methods approach enables a coherent interpretation of the collected rating data. The approach facilitates the identification of many improvement ideas, a clear competitive advantage, for the next software development cycle (major software revision/new version of the app). For detail, empirical evidence to support this statement see Chapter 4.

Therefore, in the following sections of this chapter, the readers can familiarize themselves with the managerial implications, assessment of the results in the light of the literature, limitations, and suggestions for future research.

5.1 Managerial Implications

The findings suggest several courses of action for improvement of reliability and user-friendliness of the Jaxber App, for example, the technical problems related to the interface, the speed of how the app processes the data, and the design. At the same time, these can be considered as a potential source of competitive advantage that when addressed, could improve the overall user experience, satisfaction, and consequently intention to use the app.

In the case of Usefulness property, it scored a lower average in the second year from the users' point of view. The research showed that the main reasons why users change their ratings had to do with the frequent problems that the app has with the interface and its speed. This factor obstructs the use of the app for the users and also lower scores in other properties, like Enjoyability and User-Friendliness.

In the case of the property Novelty, the statistical tests reveal that its scores have decreased, and the qualitative part of this study noted that users feel that for the App to be novel integrally, is needed to reformulate its design and adopt a contemporary style. Furthermore, users consider that the primary purpose of the app and its use in higher education systems is novel in both years.

In the case of Productivity, the statistical tests displayed an increase in its scores. The users think that the app is productive in comparison to the use of handwritten materials in the class. The constant integration of technology and education has established an advantage for the acceptance of the app. Another key external factor is the awareness of the environmental values in users because they consider that while using the app, they save paper, and this action is positive for the environment.

The property Collaborativeness did not register a statistic change over the period studied. However, the appreciation from the users in sentiment analysis shows a positive opinion. Users expressed that the app allows them to create and share content in different files, facilitates communication, and promotes interactions within a community. Nonetheless, the ratings for this property are affected because of the software error problems that the app presents, making difficult the interactions between users.

In general, users consider that the app can impact the traditional methods of study and interactions in the classroom while using the app. The concept and the purpose of the app are accepted among the users. The solution for the described problems will directly influence the ratings of the properties, Usefulness, Efficiency, User-

Friendliness, and Enjoyability. As a result, Collaborativeness may improve with the increasing frequency of use of the app. Novelty is a property that changes over time and therefore has to be analyzed considering the trends for future years.

Finally, the organization that develops the Jaxber app has to decide the priority and the order in which they could address the suggestions mentioned in this research, depending on their vision and resources. One of the objectives of this research was to identify possible sources of competitive advantage by compiling the different comments of end-users based on the user-experience evaluation approach, which were captured and analyzed by the different techniques applied in this study and in particular by the cloud of terms.

5.2 Assessment of the Results in the light of Literature

There are different studies about the Jaxber App (Krawczyk et al. 2017; Krawczyk et al. 2019; Topolewski et al. 2019). These focus on the validation of the model used as the theoretical framework of this study; they also explore different threats in the use of the mixed-methods approach in UX research. However, there is no study to-date that explores the possible creation of competitive advantage for the Jaxber App based on UX Evaluation. Nevertheless, the improvement of existing and formulation of new UX evaluation theories is beyond the scope of this thesis.

The results of this thesis aim to contribute to the generation of competitive advantage for the creators and developers of Jaxber. Grubbs (2018), stated that the product development based on UX could boost company profits. Additionally, the exploration of the needs and wants of the users of a specific product helps the companies or organizations to allocate the right resources in critical areas as well as save time and money (Blank & Dorf 2012).

The theoretical framework presented by Pallot and Pawar (2012), the Holistic model of UX, is formed by five dimensions: human, social, societal, and business. Six out of

seven of the studied properties belong to the business dimension. Therefore, the results mostly relate to the business aspect of UX, and as such support, the view presented by Bharadwaj (2002), where designing experiences for users is a strategy for sustainable competitive advantage.

The results of the sentiment analysis can provide a guideline to redefine and improve the potential updates of the Jaxber App as this information contains the experience of the users with the app. This idea is addressed by Holsapple, Hsiao, and Pakath (2014), which support the validity and importance of user comments. Furthermore, sentiment analysis can be applied as well in marketing communication strategies for targeting similar user segments or designing new marketing materials for Jaxber (Fan & Gordon 2014; Mayeh, Scheepers, & Valos 2012).

In general, the analyzed information in this research can be applied in the product development process, assuming a user-centred design approach; because the respondents in this research are the end-users of the Jaxber app. This assumption is reinforced by Gulliksen et al. (2013), who analyzed the integration of end-users to the development process of a product.

5.3 Limitations of the Research

The research was carried using only secondary data already available in the organization and collected based on the predefined design of the survey instrument. Even though both questionnaires had the same approach and were comparable from the methodological perspective, some UX properties differed for 2017 and 2018. Thus, the researcher decided to analyze only the UX properties that were repeated in both years; therefore, only seven UX properties were studied. These properties, however, were relevant from the research perspective because they belong to the business dimension of the theoretical framework, and as such, have a direct link with the competitive advantage.

As for external validity or generalization of the results, the research does not attempt to generalize them to any extent because the whole study is based on a particular case of the Jaxber App. The aspects of UX evaluation depend on the product or service, its uses, or applications, and these may vary from each case, which means that the results and main problems found in this study about the Jaxber App cannot be assumed for other products or apps similar to it. The researcher considers that this study offers a general perspective on the possible development of competitive advantage based on the users' experience in the particular case of the Jaxber App.

Concerning the time scale, the thesis represents a repeated cross-sectional study which is inferior to a longitudinal one requiring at least three subsequent data collection waves. Therefore, it offers only very limited insights into the dynamics of the phenomena. The researcher acknowledges possible bias or subjectivity regarding the UX study because of her recently acquired knowledge on the topic and her role as an end-user of the Jaxber app.

5.4 Recommendations for future research

To sum up, many important questions and issues are yet to be resolved. For example, it would be essential to develop a UX evaluation using all the four dimensions from the holistic model underlined the theoretical framework. This type of research could provide a better and more complete understanding of how the Jaxber App is perceived by its users' perspective.

Another suggestion is to conduct a second research on UX evaluation after the suggested improvements and software errors have been corrected, applied, or modified. Alternative theoretical frameworks could be identified and used or developed to study user experience.

References

- Akshi, K. & Teeja, S. 2012. Sentiment Analysis: A Perspective on its Past, Present and Future. *International Journal of Intelligent Systems and Applications*, 4, 1 – 15.
- Amadeo, A. 2019. What is competitive advantage? Three Strategies that work. *The balance*, 29 November 2019.
- Android App Releases*. 2018. Page on Statista.com website. Accessed on 16 November 2019. Retrieved from <https://www.statista.com/statistics/276703/android-app-releases-worldwide/>
- Apple App Releases*. 2018. Page on Statista.com website. Accessed on 16 November 2019. Retrieved from <https://www.statista.com/statistics/276705/ios-app-releases-worldwide/>
- Bharadwaj, A. 2002. A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation". *MIS Quarterly* 24, 1, 169-196
- Blank, S., Dorf, B. 2012. *The startup owner's manual: The step-by-step guide for building a great company*. California: K & S Ranch Inc.
- Bodker, S. & Buur, J. 2002. The design collaboratorium—A place for usability design. *Computer-Human Interaction*, 9(2), 152–169.
- Carifio, J. & Perla, R. 2008. Resolving the 50-year debate around using and misusing Likert scales. *Medical education*, 42, 12, 1150-1152.
- Cowton, C. 1998. The use of secondary data in business ethics research. *Journal of Business Ethics*, 17, 423-434.
- Creswell, J. & Clark P. 2011. *Designing and conducting mixed methods research*. 2nd ed. Los Angeles: Sage.
- Creswell, J., Plano C., Gutmann, M. & Hanson W. 2003. Advances in mixed method design. *Handbook on mixed methods in the behavioural and social sciences*, 209-240
- Das, K. 2016. A Brief Review of Tests for Normality. *American Journal of Theoretical and Applied Statistics*, 5, 5 – 12.
- Definition, benefits, and challenges. *The 20th Americas Conference on Information Systems (AMCIS)*.

- Dennehy, D. & Kasraian, L. & O'Raghallaigh, P. & Conboy, K. 2016. Product Market Fit Frameworks for Lean Product Development. *R&D Management Conference from Science to Society: Innovation and Value Creation*.
- Depaolo, C. & Wilkinson, K. 2014. Get Your Head into the Clouds: Using Word Clouds for Analyzing Qualitative Assessment Data. *TechTrends*, 58, 38-44.
- Desmet, P. & Hekkert, P. 2007. Framework of Product Experience. *International Journal of Design*, 13-23.
- Dörnyei, Z. 2007. *Research methods in applied linguistics*. New York: Oxford University Press.
- Dreyfuss, H. 1955. *Designing for people*. New York: Simon and Schuster INC.
- Dubois, A. & Gadde, L. 2002. Systematic combining: an abductive approach to case research. *Journal of Business Research*, 55, 7, 553-560.
- Eriksson, P., Kovalainen, A. 2008. *Qualitative Methods in Business Research*. SAGE Publications.
- Experience definition*. 2019. Page on oxfordlearnersdictionaries.com website. Accessed on 16 November 2019. Retrieved from: https://www.oxfordlearnersdictionaries.com/definition/english/experience_1?q=experience
- Fan, W. & Gordon, M. 2014. The power of social media analytics. *Communications of the ACM*, 57,6, 74-81.
- Friedman, H. & Amoo, T. 1999. Rating the Rating Scales. *Journal of Marketing Management*, 9, 114-123.
- Fundin, P., & Bo LS Bergman. 2003. Exploring the customer feedback process. *Measuring Business Excellence*, 2, 55-65
- Gatotoh, A., Gakuu, C., & Keiyoro P. 2017. Learner attitudes and mobile learning adoption among community health care trainees, Kenia. *International Journal of Current Research*, 9, 60834-60838.
- Geary, R. 1947. Testing for normality.' *Biometrika* 34, 209-242.
- Govers, P. & Mugge, R. 2004. I love my Jeep, because its tough like me. The effect of product personality congruence on product attachment. *International Conference on Design and Emotion*.

Grubbs, JC. 2018. How Design and UX Create Sustainable Competitive Advantage. *Tandem Blog*, 1 July 2018. Accessed on 6 December 2019. Retrieved from <https://madeintandem.com/blog/design-ux-sustainable-competitive-advantage/>

Gulliksen, J., Göransson, B., Boivie, I., Blomkvist, S., Persson, J., & Cajander, Å. 2003. Key principles for user-centred system design. *Behaviour and Information Technology*, 22, 397-410.

Halvey, M. & Keane, M. 2007. An assessment of tag presentation techniques. *International World Wide Web Conference (WWW2007)*, 16, 1313-1314.

Hartson, R. & Pyla, P. 2012. *The UX Book: Process and Guidelines for Ensuring a Quality User Experience*. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.

Hassenzahl M. & Tractinsky N. 2006. User experience - a research agenda. *Behaviour & Information Technology*, 25.2, 91-97

Hassenzahl M. 2007. The Hedonic/Pragmatic Model of User Experience. *Towards a UX Manifesto*, 10-14.

Hassenzahl, M. 2003. The thing and I: understanding the relationship between user and product. *Funology. Usability to Enjoyment*, 31 – 42.

Heale, R. & Forbes, D. 2013. Understanding triangulation in research. *Evidence-based nursing*, 16.

Hekkert, P. 2006. Design aesthetics: Principles of pleasure in design. *Psychology Science*, 8, 157 - 172.

Holsapple, C., Hsiao, S., & Pakath, R. 2014. Business social media analytics: interactive contexts. *CHI Conference*, 915–918.

International Standardization Organization (ISO). 2010. ISO DIS 9241-210:2010. *Ergonomics of human system interaction -Part 210: Human-centered design for interactive systems*.

Jamieson, S. 2004. Likert scales: how to (ab) use them. *Medical education*, 38,12, 1217-1218.

Jetter, Hans-Christian & Gerken, Jens. 2006. A Simplified Model of User Experience for Practical Application. *User eXperience - Towards a unified view*, 106-111.

Johnston, M. 2014. Secondary Data Analysis: A Method of which the Time Has Come. *Qualitative and Quantitative Methods in Libraries (QQML)*, 619 –626.

Krawczyk P., Topolewski M. and Pallot M. 2017. Towards a reliable and valid mixed methods instrument in user eXperience studies. *International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, Funchal, 1455-1464.

- Krawczyk, P., Maslov, I., Topolewski, M., Pallot, M., Lehtosaari, H. & Huotari, J. 2019. Threats to Reliability and Validity of Mixed Methods Research in User eXperience. *IEEE International Conference on Engineering, Technology and Innovation*, 1-7.
- Krupnik, S. 2012. Evaluating the social mechanism of investment subsidies using an abductive approach. *Evaluation*, 466–476.
- Kruskal W. & Wallis, W. 1952. Use of Ranks in One-Criterion Variance Analysis. *Journal of the American Statistical Association*, 47, 260, 583-621.
- Kujala, S. & Miron-Shatz, T. 2013. Emotions, experiences and usability in real-life mobile phone use. *Conference on Human Factors in Computing Systems*, 1061-1070.
- Kuzon Jr, W., Urbanchek, M., & McCabe, S. 1996. The seven deadly sins of statistical analysis. *Annals of plastic surgery*, 37,3, 265-272.
- Lallemant, C., Gronier, G., & Koenig, V. 2015. User experience: A concept without consensus? Exploring practitioners' perspectives through an international survey. *Computers and Human Behaviour*, 43, 35-48.
- Lauralee, A. 1996. Quality of experience: defining the criteria for effective interaction design. *Interactions* 3, 3, 11–15.
- Lavrakas, P. 2008. Encyclopedia of survey research methods (Vols. 1-0). *Thousand Oaks, CA: Sage Publications, Inc.*
- Liu, B. 2009. *Handbook of Natural Language Processing*. New York: Marcel Dekker, Inc.
- Magnavita, N., Heponiemi, T. 2012. Violence towards health care workers in a Public Health Care Facility in Italy: a repeated cross-sectional study. *BMC Health Serv Res* 12, 108.
- Mahlke, S., Thüring, M. 2007. Studying antecedents of emotional experiences in
- Mayeh, M., Scheepers, R., & Valos, M. 2012. Understanding the role of social media monitoring in generating external intelligence. *ACIS 2012: The 23rd Australasian Conference on Information Systems 2012*, 1-10.
- Mckee, S. 2014. Presenting Qualitative Survey Data with Word Clouds. *Surveygizmo Data Blog*. Accessed on 27 February 2020. Retrieved from <https://www.surveygizmo.com/resources/blog/qualitative-data-word-cloud/>
- Menold, N., & Bogner, K. 2016. Design of Rating Scales in Questionnaires. *Leibniz Institute for the Social Sciences -GESIS Survey Guidelines*.

- Merriam, S. 1998. *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.
- Mokaya, S., Lovega, J., Wagoki, J., & Karanja k. 2013. Effects of Organizational Work Conditions on Employee Job Satisfaction in the Hotel Industry in Kenya. *International Journal of Arts and Commerce*, 2, 79-90.
- Morse, J. & Niehaus L. 2009. Mixed Method Design. *Principles and procedures*.
- Morse, J. & Niehaus L. 2009. Mixed method design: Principles and procedures. *Walnut Creek: Left Coast Press*
- Mullins, J. & Komisar, R. 2009. *Getting to plan B: Breaking through to a better business model*. Harvard Business Press.
- Norman, D. & Nielsen, J. 2006. Nielsen Norman Group Articles. *The Definition of User Experience (UX)*, 1 March 2006. Accessed on 18 November 2019. Retrieved from <https://www.nngroup.com/articles/definition-user-experience/>
- Norman, G. 2010. Likert scales, levels of measurement and the “laws” of statistics. *Advances in health sciences education*, 15,5, 625-632.
- Nyman, N. 2005. The User Experience equation. *Professional Blog Press*. Accessed on 18 January 2020. Retrieved from <http://nnyman.com/personal/2005/11/18/the-user-experience-equation/>
- Pallot, M. & Pawar, K. 2012. A holistic model of user experience for living lab experiential design. *International Conference on Engineering, Technology and Innovation*, 1-15.
- Pallot, M., Kalverkamp, M., Vicini, S., Trousse, B., Vilmos, A., Furdik, K., Nikolov, R. 2014. An Experiential Design Process and Holistic Model of User Experience for Supporting User Co-creation. *Open innovation Yearbook 2014, Directorate-General for Communications Networks, Content and Technology, Luxembourg: Publications Office of the European Union*.
- Parducci, A. 1983. Category ratings and the relational character of judgment. *Advances in Psychology*, 11, 262-282.
- Patton, M. 1987. *How to use qualitative methods in evaluation*. London: Sage.
- Pessoa, M & Trabasso, L. 2017. The Product Development System. *The Lean Product Design and Development Journey: A Practical View*, 3-18.

Quality education. 2019. Page on Un.org website. Accessed on 16 November 2019. Retrieved from: <https://www.un.org/sustainabledevelopment/education/>

Rambocas, M. & Gama, J. 2003. Marketing Research: The role of sentiment analysis. Portugal: FEP Working Series Papers.

Rockwell, Chris. 1999. Customer connection creates a winning product: building success with contextual techniques. *Interactions*, 6, 50-57.

Rohrbeck, R. Günzel, F. & Uliyanova, A. 2012. Business Model Innovation: The Role of Experimentation. *R&D Management Conference*.

Roto, V. 2007. User Experience from Product Creation Perspective. *Towards an UX Manifesto* 31–34.

Roto, V., Nuutinen, M., & Smedlund, A. 2014. UX HOW? A Glimpse of User Experience for B2B Industry – Issue 2. *User Experience and Usability in Complex Systems –program, Finnish Metals and Engineering Competence Cluster (FIMECC)*. Accessed on 25 February 2020. Retrieved from: <http://docplayer.net/42695736-A-glimpse-of-user-experience-for-b2b-industry-issue-2.html>

Russell, M. 2001. The Effective Use of Secondary Data. *Learning and Motivation* 33, 32–45.
Sampling. Belmont: Thomson Brooks/Cole.

Saunders, M., Lewis, P., & Thornhill, A. 2009. *Research methods for business students*. 5th ed. Essex: Pearson Education Limited.

Sawyer, Steven. 2009. Analysis of Variance: The Fundamental Concepts. *Journal of Manual & Manipulative Therapy*, 17. 27-38.

Scheaffer, R., Mendenhall W., & Lyman O. 2006. *Elementary Survey*

Schoonenboom, J. & Johnson, R. 2017. How to Construct a Mixed Methods Research Design. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie [KZfSS Cologne Journal for Sociology and Social Psychology]*.

Sean, D. 2019 How Much Is Google Worth? *GoBanking Rates Blog*, 5 February 2019. Accessed on 6 December 2019. Retrieved from <https://www.gobankingrates.com/making-money/business/how-much-is-google-worth/>

Shamoo, A. & Resnik, B. 2003. *Responsible Conduct of Research*. Oxford University Press.

Sharma, Sohil. 2019. PhD Thesis. Horizons University, School of Business, Degree programme on International Management. Accessed on 16 March 2020. Retrieved from: https://www.researchgate.net/publication/333220406_Descriptive_Statistics

Silva M. & Fellipe C. 2018. Secondary Data in Research – Uses and Opportunities. *Revista Ibero-Americana de Estratégia [Ibero-American Magazine of Strategy]*, 1-4.

Smith, E. 2019 How experience design can fuel competitive advantage. *Devbridge Blog*, 14 June 2016. Accessed on 6 December 2019. Retrieved from <https://www.devbridge.com/articles/experience-design-fuels-competitive-advantage/>

Stevens, E. 2019. The Fascinating History of UX Design: A Definitive Timeline. *Career Foundry Blog*, 19 July 2019. Accessed on 16 November 2019. Retrieved from <https://careerfoundry.com/en/blog/ux-design/the-fascinating-history-of-ux-design-a-definitive-timeline/>

Stubbart, C. & Knight, M. 2006. The case of the disappearing firms: empirical evidence and implications. *Journal of Organizational Behavior*, 79-100.

Sward, D. & Macarthur, G. 2007. Making User Experience a Business Strategy. *Towards a UX Manifesto*, 35-42.

Tailor, G. 2005. *Integrating quantitative and qualitative methods in research*. 2nd ed. Maryland: University Press of America Inc.

Teddlie, C., & Abbas Tashakkori. 2009. *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Los Angeles: SAGE Publications Inc.

Ten things we know to be true. 2019. Page on Google.com website. Accessed on 6 December 2019. Retrieved from <https://www.google.com/intl/en/about/company/philosophy/>

The value of Design. 2018. Page on dmi.org website. Accessed on 5 December 2019. Retrieved from https://www.dmi.org/page/DesignValue/The-Value-of-Design-.htm&as_qdr=y19

Topolewski, M., Lehtosaari, H., Krawczyk, P., Pallot, M., Maslov, I., & Huotari, J. 2019. *Validating a User eXperience Model through a Formative Approach: an Empirical Study*. *IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, 1-7.

Trochim, W. & Donnelly, J. 2008. The Research Methods Knowledge Base. *Thomson Custom Pub, Mason, OH*

UK Data Service. 2015. Analyzing change over time: repeated cross sectional and longitudinal survey data. UK Data Service Blog, 1 February 2015. Accessed on 24 December 2019. Retrieved from <https://www.ukdataservice.ac.uk/media/455362/changeovertime.pdf>

User Experience Professionals' Association. 2008. Glossary. *Usability Body of Knowledge*. Accessed on 18 November 2019. Retrieved from <http://www.usabilitybok.org/glossary>

Vartanian, T. 2010. Secondary Data Analysis. *Oxford University Press*. Accessed on 30 December 2019. Retrieved from <https://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780195388817.001.0001/acprof-9780195388817>

Vigderhous, G. 1977. The level of measurement and “permissible” statistical analysis in social research. *Pacific Sociological Review*, 20,1, 61-72.

Wadell, H. 1995. Getting a straight answer. *Marketing Research* 7, 5-8.

What is the Difference Between Population and Sample?. 2019. Page on Statisticssolutions.com website. Accessed on 8 January 2020. Retrieved from <https://www.statisticssolutions.com/what-is-the-difference-between-population-and-sample/>

Where UX Comes From. 2013. Page on UxBooth.com website. Accessed on 20 November 2019. Retrieved from <https://www.uxbooth.com/articles/where-ux-comes-from/>

Zohrabi, M. 2013. Mixed Method Research: Instruments, Validity, Reliability and Reporting Findings. *Theory and Practice in Language*

Appendix 1

Questionnaire

1. Please rate the ENJOYABILITY of Jaxber app. Where (1) means not-enjoyable (2) mostly not-enjoyable, (3) almost enjoyable, (4) mostly enjoyable, and (5) enjoyable
Explain the reasons behind your rating of the enjoyability of the Jaxber app.
2. Please rate the USEFULNESS of Jaxber app. Where (1) means not-useful (2) mostly not-useful, (3) almost useful, (4) mostly useful, and (5) useful
Explain the reasons behind your rating of the usefulness of the Jaxber app.
3. Please rate the PRODUCTIVENESS of Jaxber app. Where (1) means not-productive (2) mostly not-productive, (3) almost productive, (4) mostly productive, and (5) productive
Explain the reasons behind your rating of the productiveness of the Jaxber app.
4. Please rate the EFFICIENCY of Jaxber app. Where (1) means not-efficient (2) mostly not-efficient, (3) almost efficient, (4) mostly efficient, and (5) efficient
Explain the reasons behind your rating of the efficiency of the Jaxber app.
5. Please rate the NOVELTY of Jaxber app. Where (1) means old-fashioned (2) mostly old-fashioned, (3) almost new, (4) mostly new, and (5) new
Explain the reasons behind your rating of the novelty of the Jaxber app.
6. Please rate the COLLABORATIVENESS of Jaxber app. Where (1) means not-collaborative (2) mostly not-collaborative, (3) almost collaborative, (4) mostly collaborative, and (5) collaborative
Explain the reasons behind your rating of the collaborativeness of the Jaxber app.