The role of value proposition in the user engagement of effective eHealth platforms for Type 1 Diabetes patients

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ABSTRACT,

Digital platforms are making advanced progresses due to the growth of digitalization. Especially affected is the health care sector, which profits from new innovations and improvements in data storage. However, existing literature reasons that the user engagement of eHealth platforms for patients requiring services for controlling their disease are still relatively low. The focus of this study is on Type 1 Diabetes patients because blood glucose monitoring platforms are one of the most popular options if Diabetics want to control their chronical illness and to prevent any negative consequences. Multiple publications argue that in order to increase the user engagement of these platforms the right value propositions need to be identified, which match the patients' needs and demands. This thesis examines the role of value proposition in the user engagement of effective eHealth platforms for Type 1 Diabetes patients. It was found that the concept of user experience plays an essential role, when linking value proposition with user engagement. Qualitative research was used, which consisted of semi-structured Interviews with nine participants, which were selected through a purposive sampling approach to gain valuable results. The outcomes show a significant influence of value proposition on user engagement. It was indicated that if the promises a company makes regarding the jobs the platform should conduct match with the users' needs and demands the user experience is going to be positively influenced. The experience is then indicated via four components, which decide if the user will keep interacting with the platform or if disengagement will occur.

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1. Introduction

The advanced progress of digitalization in the last decade was a great driver for new digital platform developments. EHealth platforms helps the communication between different actors. It also, can be used to share data and to set a specific standard for communication (Benedict et al., 2015). Even though the evolution of digital solutions offers continuously fast access to stored data the number of users of those platforms is still relatively low. A study from the year 2019 showed that only 29% of users from different industries are still engaged in app services after 90 days, without any known clear explanations why this is the case (Druce, Dixon, McBeth, 2019). An explanation for the low user number might be that the provided services and the current structure of them does not meet the needs and demands of the target group. Therefore, a lack between the potential of digital platforms and the actual number of customers exists. There are several reasons to explain the status quo but the term *user engagement* might play an essential role. This term describes the process of creating maximal performance of a platform (Brodie et al., 2011). Also, it can be compared with the interaction between a machine and a person (Lalmas et al., 2014). Another important aspect for the user engagement is the *value proposition*. The perceived value for the customer is the main influence for creating motivation and therefore, long term engagement of the service. This factor is the connection between the two components of the process from building a platform and making it attractive for potential users to having a high user engagement (Kim et al., 2013).

The drive of digitalization and new technical innovations created new opportunities influencing especially the whole health care sector (Gómez et al., 2014). Among other things self-managing platforms can increase the life quality of Type 1 Diabetes patients and are able to prevent any drastic health consequences when it is used in the right way consistently. Type 1 Diabetics are the minority of all Diabetics worldwide but are depended on health monitoring devices their whole life since this disease is not curable unlike for Type 2 Diabetics. Additionally, a lot of kids and teenagers are affected by Type 1 Diabetes and that is why organizations need to offer user friendly and easy-to-operate platforms (Daneman, 2006).

Not only can a high user engagement of eHealth platforms improve the health of thousands, but it can also have positive effects on the economy. For example, it does avoid hospitalization in the case of diabetics and therefore, can make space for other emergencies. By improving the health of millions of patients this could have an impact of up to 1.6 trillion $ per year in 2025 (Manyika et al., 2015). But in order to create advantages for all sides as many as possible people in need have to use systems effectively. Those services provide details about the fluctuations of the blood glucose level while being really accurate and help to early indicate possible problems (Klonoff, 2005).

This leads us to the research questions of this thesis: *"How do value propositions influence the user engagement of eHealth platforms for Type 1 Diabetes patients?"*

In the process of answering the paper's research questions following sub-questions will be discussed as well:

1. *How is value proposition defined in existing literature?*
2. *How is user engagement defined in existing literature?*
3. *What is the relationship between value proposition and user engagement?*

While answering this research question the customers' value proposition will first be discussed. In order to have patients engage with platforms the users' needs and demands have to be met. Businesses with new innovations should have strong value propositions to show potential customers what kind of benefits they will get from this service. In the health care sector, the most important demands of patients are the degree of difficulty to access the service, life-quality, and the time until receiving care (Porter et al., 2016).

Nevertheless, every target group has different needs and other characteristics they expect from their health care service (Sibalija et al., 2021).

The research questions will be analyzed by looking at certain theories first, which can be applied according to the topic. Here, we look at the two main concepts of this research, which are *value proposition* and *user engagement* with the focus on platforms for Type 1 Diabetes patients. In chapter three the methodology is going to be discussed by explaining the setting, subjects, data collection and data analysis of this study, followed by the result of the conducted Interviews. The fifth chapter is strongly based on the previous one since the outcomes of the qualitative research are going to be discussed by referring the answers to the given theories. In chapter six the research question is going to be answered considering the findings and discussion of this paper.

The purpose of this analysis is to gain further insights about the process of creating more user engagement within eHealth platforms in the health care sector, specifically for Type 1 Diabetes while investigating which role the user engagement plays in this development. Furthermore, this research will be adding knowledge for literatures which discuss the creation of self-managing devices for Type 1 Diabetes trying to increase the engagement with a customer close service with the aim that patients use the service long-term.

2. Theoretical Framework
2.1 Value proposition

Value propositions are the advantages the user can expect from a service or product. Questions for indicating the value propositions are for example: Why do customers chose using this certain service and not an alternative? And, what makes the service stand out from the rest? (Osterwalder et al., 2015). Meeting customers' needs and demands creates value with the aim to increase the engagement to get the users attention. When the platform then satisfies the person, they are more likely to be loyal towards the company and stay engaged because it makes the experience of use valuable for customers (Kim et al., 2013).

Osterwalder et al (2015) illustrates the concept of value proposition as a specification of the business model canvas. The business model canvas helps to design efficient business models by creating customer close services and therefore, increase the engagement and effectiveness of a platform. Customer close services are being offered when the benefits and advantages of the platform matches the expectations and demands of its users. A service can be considered as 'successful' when a target group use or buy the product continuously. That is the reason why the demands and needs of potential users are the most important step when coming up with inventions (Hassan, 2012). The aim of the value proposition model is to ensure that the product and the market are compatible. The authors therefore divided this model into two blocks each with three subcategories. (Osterwalder et al., 2015).

On the one side is the *value proposition map*, which is a more structured and detailed description of the aspects of a given value proposition in the original business model. In order to attract end

users, the canvas purposes three different blocks, which first of all, consists of a list of the products and services the business is going to present. The authors distinguished between four different product and service types: *Physical/tangible, intangible, digital, and financial.* The second one is called *gain creators* and is about the way how the company wants the product or service to achieve great value. Here, the most important aim should be the satisfaction of users. Describing the way how the business can relieve its customers from pain, for example high costs, large time consummation, a bad feeling, or potential risks is the third aspect of the value proposition map. Identifying the *pain relievers* improves the understanding of misgivings people might have before using an innovation or new service (Osterwalder et al., 2015).

The *customer profile* on the other side provides a more accurate description of a certain customer segment. This block is also divided into three subcategories. The first section is called *customer jobs* and concerns the aims consumers have regarding their job or daily life. It describes the things and challenges people want to solve and which needs they want to please. There are three types of jobs: *Functional jobs, social jobs*, and *personal/emotional jobs.* The second aspect from the profile is the *customers pains* and here one identifies factors, that disturbs or irritates consumers about the jobs or things that avoid someone from doing their job. Again, the authors identify three different types of pains: *Undesired outcomes, problems and characteristics, Obstacles, and risks.* The last important factor for creating an accurate customer profile for a new service is the *customer gains,* which describe the advantages the customer wants from the product. There are four different forms: *Required, expected, desired and unexpected gains* (Osterwalder et al., 2015).

The perfect fit arises when the *value proposition map* and the *customer profile* match with each block and balance each other out. Only when the service or product match with the most important customer pains and gains the product-market fit is successfully achieved and the engagement increases (Osterwalder et al., 2015).
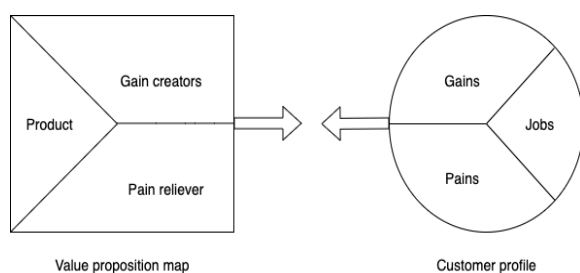
Figure 1. Value proposition canvas

An addition to the original business canvas from Osterwalder and Pigneur is called *the triple layered business model canvas* and is based on the literature from Joyce and Paquin (2016). This concept adds two more layers for a more sustainable innovation and is rather long-term oriented and adapts towards the current environment. The model consists out of the economic, the environmental life cycle, and social stakeholder layer. It acts as an extension to the business model canvas and highlights the organizational impacts (Joyce & Paquin. 2016).

Due to today's issues business are more under pressure than ever. Wars, financial crisis, inequality, and environmental tragedies makes it a big challenge for firms to meet the standards of the society, while also offering sustainable services (Joyce & Paquin. 2016).

The extended version of Osterwalder´s business model is especially important for the health care sector since it takes all important social factors for a long-lasting service into consideration. Furthermore, the service and its functions are based on stakeholder´s interests, which makes close to the needs and demands of the patient (Joyce & Paquin. 2016).

2.2 User engagement

User engagement or also called customer engagement can be defined in many different ways but the most common and general definition is as follows:

"Customer engagement (CE) is a psychological state that occurs by virtue of interactive, cocreative customer experiences with a focal agent/object (e.g., a brand) in focal service relationships. It occurs under a specific set of context dependent conditions generating differing CE levels; and exists as a dynamic, iterative process within service relation- ships that cocreate value. CE plays a central role in a nomological network governing service relationships in which other relational concepts (e.g., involvement, loyalty) are antecedents and/or consequences in iterative CE processes. (...)" (Brodie et al., 2011).

This term is not unknown for the busines world since it is a strategic approach to receive maximal performance and effectiveness (Brodie et al., 2011). In literature of the marketing sector, it describes the process of creating brand awareness through promotions and creating a unique experience for users. For the health care sector, the brand would be represented by the eHealth platforms. The aim is to build a strong relationship, which will be existing long-term. A high degree of engagement can also be a driver for new innovations, new product or service developments and a viral marketing movement (Hollebeek et al., 2019). Brodie et al. (2011) states that user engagement can be analyzed and summarizes as a multidimensional concept. It proposes that engagement focuses on either the behavioral, cognitive, or emotional perspective but overarching between the three aspects is also possible. Furthermore, the authors O'Brien and Toms divided the process of engagement into four stages, which are *point of engagement, reengagement, engagement,* and *disengagement.* First the target groups attention and interest need to be drawn to the service in order to gain users. Next the business wants to strengthen the relationship with its users to make them interact continuously with the platform or product. Lastly, engagement can also end in disengagement. This can happen for many different reasons but is unprofitable for the firm itself. Losing the relationship and interaction with a user can be the consequence from, for example the factors of the external environment or dissatisfaction of the service (O'Brien & Toms. 2008). Furthermore, Lalmas and O'brien compare the word engagement with the interaction between a human and machines.

"The concept of "direct engagement" emphasized the interaction between human and machine, whereby the users' cognitive intentions could be realized through the physical manipulation of the interface." (Lalmas et al., 2014).

Looking at user engagement for especially mobile app services, technology companies need to focus more on what the target group is looking for in their device and for what purposes the smartphone is used to increase the engagement. The experience customers are looking for with their device can be motivated socially, functionally, or by pleasure. An essential role in order to increase user engagement is the technological acceptance.

Customer nowadays want to choose when, how, and where to engage with the services (Kim et al., 2013).

A study from the year 2021 investigated how the user engagement of diabetes apps proceeded over a two-week time frame. 38 out of 58 participants indicated that they used the app properly, which reflects the still existing challenges in terms of the acceptance and attractiveness of monitoring platforms for diabetes patients. The contestants of the experiment stated that the usage of the app was too complicated and that it also consumed a too much time (Maharaj et al., 2021).

2.3 Relationship between value proposition and user engagement

Engagement occurs when an interaction happens to satisfy the user's needs and demands (Kim et al., 2013). The perceived value of a platform influences the interaction between a user and the service. Especially for digital platforms, which require a technological understanding the compatibility between the demands and features is of particular note (Di Gangi & Wasko, 2016). Multiple literatures reason that the missing values are the main reason for a low user engagement in the Diabetes field. Patients complain about the missing integration of their needs and demands. Therefore, the number of disengagements keep being relatively high because of the lack of value (Trawley et al., 2017). Due to the different expectations of various individuals with diverse backgrounds the values get perceived differently. For example, a young Diabetes patient, who got diagnosed only days ago expects other value propositions than an older patient with 50 years Diabetes experience. In the rare case that the user engagement is high, but the value proposition remains low a short time period of hype occurs, but this cannot lead to long-term success of the service. If the value proposition is high, users will create locality towards the brand and an increase of engagement will be noticed (O'Brien & Toms, 2008).

An important intermediate step between the value proposition and the user engagement is the actual platform experience. The aim of the value proposition is to create customer close service to offer users a satisfying and a trouble-free experience (Sandström et al., 2008). A *service experience* is defined as: *"Service experience is an actor's subjective response to or interpretation of the elements of the service, emerging during the process of purchase and/or use, or through imagination or memory."* (Jaakkola et al., 2015).

Various literatures specify and elaborate factors, which can be analyzed when indicating the user experience. A general model about self-service technology, that showed a lot of overlapping's of other theories states that there are four components directly influencing the user experience: *Personalization, aesthetics, perceived time, and trust in government.* Personalization is about meeting a customer's individual and unique demand to create a satisfying experience. The second factor, which the experience can be evaluated with is the degree of usability and the degree of meeting users' preferences regarding the platform's features. Multiple studies show that the time spent on the service is another important crucial point many potential customers are aware of since the society tend to be me conscious of their time. Lastly, the security and trust in the Government worries digital service users. Transparency can positively influence the degree of trust towards politicians and public officials. This author states that a good level of trust in the government positevly effects the user's opinion about a platform. Multiple studies also show that patients are then more acceptable towards a service since they believe in more accurate and trustworthy results. Therefore, the relationship

between the patient and platform gets stronger and the user engagement is more likely to increase (Chen et al., 2021).

Combining all concepts, the first step for indicating the user engagement the value propositions offered by the platform needs to be analyzed by elaborating the value propositions map and customer profile according to Osterwalder's literature (2015) of Type 1 Diabetes patients. That influences the user experience, which is divided into four components: Personalization, aesthetics, perceived time, and trust in government. These aspects directly influence the degree of influence, but one has to keep in mind, that great user experience does not necessarily lead to a high user engagement (Lalmas et al., 2014).

For this study it is expected that a matching value proposition map and customer profile positively influences the user experience of Type 1 Diabetes patients. If the platform shows great value and a significant experience measured by the four components mentioned above the user engagement is most likely to increase and remain steady.
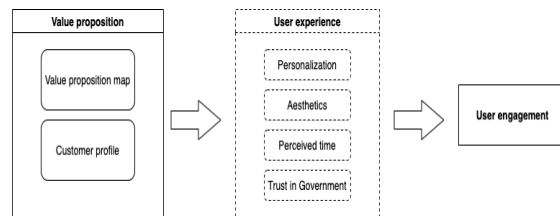
Figure 2. Relationship between value proposition and user engagement

3. Methodology
In this chapter the methodology of this study is going to be discussed by determining the setting, subjects, data collection and data analysis.

3.1 Research Sample
Picking a suitable sample is the main key to gain important information and characteristics of the investigated topic. A definition of the term *sample* is as followed: *"A sample is a finite part of a statistical population whose properties are studied to gain information about the whole"* (Mugo, 2002).

In this research the role of value proposition on the user engagement of eHealth platforms will be analyzed in the case study of Type 1 Diabetes. Also, it is an emerging topic because 2017 the number of cases of Type 1 Diabetes was estimated to be at around nine million (Green et al., 2021) but the user engagement of monitoring devices and platforms in the health care is still low (Böhm et al., 2020). The target group was being even more particular sampled by analyzing the case of Type 1 Diabetes patients only. This form of Diabetes is rarer than Type 2 since only 5 to 10 % of all Diabetes cases affected with Type 1. Patients get diagnosed often very early in life and the disease is mainly caused by genetic backgrounds and an immune system malfunction. Furthermore, this sample is chosen because these people are depended on insulin and the platforms their whole life since the glucose level cannot by kept steady without medication unlike Type 2, where the insulin dependency can be nearly stopped with the right treatment (Daneman, 2006). Following a study, the precise monitoring and analysis of the blood glucose level helps to prevent negative effects caused by a high level of blood sugar (Sorkin et al., 2005). In order to collect the data of diabetes patients the most important aspect of the health monitoring systems are the hardware sensor platforms, which

measure for example the heart rate, the temperature, and the glucose level (Swan, 2012). All information gets transmitted to the cloud on the patient's smartphone via the internet network and those can also be viewed by the caregiver, which is most of the times their medical practitioner (AlShorman et al., 2020). The sensors of continuous glucose monitoring devices, which are attached to the patient's skin automatically take blood samples every five minutes and sends the value to the receiving app. The device then displays the blood glucose level, and the user can identify up and downs. From the device a command for insulin can be issued. Furthermore, the device alerts when the blood level is too high or too low (Roze et al., 2021). An alternative for Diabetes patients other than continuous blood glucose monitoring platforms are blood glucose test stripes. For this method the patients have to prick themselves in the finger to receive a blood sample. A drop of blood is then applied onto a test stripe and then inserted into a device called photometer. It can take up to 5 minutes to receive the result. Afterwards, the blood glucose value can be seen on this device (CADTH. 2010).

The research is going to be investigated in a case study in which doctors who are specialized in Diabetes and use continuous blood glucose monitor platforms, mainly FreeStyle Libre and Dexcom to monitor the health and the patients as the platform users are going to be asked about the usage. Therefore, contact with one practitioner from Germany and eight Type 1 Diabetes patients was established. The doctor represents the platform and their organization since he works together with a popular firm and promotes the FreeStyle Libre in his office, which constructs those sensors, transmitters, and devices. And the patients are the users of the platform. The age of the interviewees ages varies between 24 and 63 years. All were willing to be interviewed to create input for the research paper.

3.2 Data Collection
A suited method is needed to answer the papers research question, which depends on the knowledge one wants to gain during the data collection. For this study qualitative research is used since the aim is to acquire as much detailed information as possible by interviewing people, which are the most relevant for the research objective like Type 1 Diabetes patients or practitioners focusing on Diabetes. Interviews different kind of structures are the most common and popular method when approaching to collect data. The main purpose of Interviews is to achieve qualitative clear and detailed information from the Interviewees experience from a descriptive point of view. The interpretation and further analyzation are the responsibility and task of the Interviewer (DiCicco-Bloom & Crabtree, 2006). For the Interviews a purposive sampling approach was used to achieve data from people involved in the case study of Type 1 Diabetes patients. This method helps to gather valid and valued information for the discussion and the answer to the research question because a sample was used that is directly in contact with Type 1 Diabetes and have a great in-depth knowledge about this the topic of this research (Bell et al., 2022). In the health care sector semi-structured Interviews is the most applied method, which is also used in this study. This Interview style should be conducted with people who have personal experience with the topic one is going to be asked about to have valid and high valued data. It gives the Interviewee a lot of freedom to further elucidate their answers and it is also possible to come up with spontaneous follow-up questions (DeJonckheere & Vaughn, 2019). The data regarding value proposition was obtained via an Interview with a general practitioner focusing on Diabetes, while the results for user engagement and user experience was conducted by interviews with Type 1 Diabetics.

The Interview questions were divided into three groups following the different concepts that are used for this research paper: 1. Value proposition 2. User Experience and 3. User engagement (Appendix B & C). Furthermore, a table was created with the literature references on which the interview questions are based on (Appendix F).

The Interviews were held in the Interviewees native language which is German to prevent any miscommunication due to translation difficulties. Furthermore, the quality of the data increases since people can express themselves better with their mother tongue and are able to explain their answers in more detail. Two Interviews were accomplished via face-to-face conversation and 7 Interviews were conducted online.

In the first part of the Interview an introduction was given, while explaining the papers' topic and research question. Some important background information was elaborated and after that it was asked for permission to audio record the Interview. In the second segment the actual questions were asked in order to have liable and valued data in order to answer the research questions (Appendix A & B & C).

After all Interviews were conducted a total of around 2 hours and 40 minutes of audio material were accomplished for further analyzations.

3.3 Data Analysis
Analyzing the gained data from the Interviews the recorded audio needed to be transcribed first. Due to the length of all interviews together the help of an internet tool was required. For this step the software Amberscript was used, which automatically transforms the audio one uploads into a written text. After the first step content analysis is used to work on discussing the findings. Krippendorff (2018) defines it as follows *"Content analysis is a research technique for making replicable and valid inference from texts (or other meaningful matter) to the context of their use.".* This data collection method was used to identify a certain intention or meaning of a qualitative data collection by detecting particular words or expressions in a text. The anticipated and best way to perform this analysis is when the interviews are being coded (Krippendorff, 2018). The coding approach involves identifying certain aspects or passages of the transcript interviews to link them afterwards to a certain category of a study field. The author Gibbs (2021) explains the usage of *coding* as follows: *"Coding is a way of indexing or categorizing the text in order to establish a framework of thematic ideas about it."* The best way to code interviews that got transformed into a text is the line-by-line coding approach (Gibbs. 2021). Here, one codes every line of the text according to the topic of this study and the relevant factors for the research question that were already indicated in 2.1, 2.2 and 2.3. After that these codes were categorized into seven groups: 1. Product 2. Gain creators 3. Pain relievers 4. Jobs 5. Gains 6. Pains 7. Personalization 8. Aesthetic 9. Perceived time 10. Trust in Government 11. User engagement.

This data analysis process will lead this paper to its goal to answer the research question.

4. Results
In this chapter the findings on value proposition (4.2), user experience (4.3) and user engagement (4.4) will be outlined to identify the relationship.

4.1 Overview results

In appendix D and E the summarized results can be found in form of tables. Hereby, the findings on the categorize divided in the section 3.3 are shown. Furthermore, those characteristics already show a tendency towards the role of value proposition in the user engagement of eHealth platforms for Type 1 Diabetes patients and how the engagement and interaction get influenced by other factors, which will be further elaborated in the discussion section.

4.2 Value proposition

The findings in this section were established through an Interview with a diabetologist, who is a board member in a committee, which debates about how to improve health care devices and eight Interviews with Type 1 Diabetes patients.

4.2.1 Value proposition map

The Interviewee explained that there are two different kinds of services within the diabetes glucose measuring versions. The offline version can only be accessed by the patient itself and no data will be uploaded to the Cloud. The online version represents eHealth platforms and describes through Bluetooth interacting devices. *"And we as therapists can access this app via the Internet, so to speak, and can also look at the blood glucose values. This is this platform, and this is a so-called online version, and it works via Bluetooth."*. In order to achieve a great degree of gain creators the respondent argues that the organization of continuous blood glucose monitoring platforms try to offer accurate and timely blood glucose values. The diabetologist also stated that firms integrated alarms into the device, which makes a loud noise if the level is under 70. Another gain creator is, that they offer a fast and reliable customer service if the patient needs help. However, the Interviewee expressed that a lot of manufacturers and the companies of eHealth platforms are self-centered and take advantage of the fact, that there is little competition on the market. *"The manufacturers are quite arrogant. They just do their thing. They also do their own advertising. They try to make sure that every patient or every diabetic gets this device."*.

A pain reliever for Type 1 Diabetes patients that was mentioned by the participant is the better control over consequences triggered by an out-of-range blood glucose level. Therefore, the long-term values and health in general of the patient improves. Also, the patients do no longer need to manually take blood drop samples themselves and therefore, saves a lot of time and effort. The application and procedure of these devices are illustrated in Appendix G. The diabetologist states: *"And that has led to the fact that the blood glucose levels on average [...] are getting better [...] by 0.5%. That's good. That means for the patient that he has better blood sugar levels, and this means for him that he has less hypoglycemia and heavier convictions."*

4.2.2 Customer profile

All eight Types 1 Diabetes patients have the same expectation regarding the jobs their platform should fulfill. They want to have an easier alternative to monitor their blood glucose level. One Interviewee explained: They aim is to gain more security in relation to the negative consequences due to an unbalanced blood sugar level. Several Interviewees also mentioned that before using eHealth platforms they expected to have all important data on one device to have better control over their health. *"[...] I was then able to really see my sugar continuously for once. [...] I see how my blood sugar runs all the time, because that was not given before that at all and accordingly, I also had no good long-term values."*

All Diabetics already had at least one experience with factors that prevented the platform from motoring blood glucose levels. All preventions were created by technical failures, for example pump malfunctions or broken sensors. Two of the Interviewees also complained about allergic reactions because of the glue that helps to attach the sensor to the skin. Those people had no other way than switching to another company. One of these two patients did also react badly to other continuous blood glucose monitoring companies' devices and switched back to test strips. This Interviewee stated: *"[...] and I have of course once had these sensors in my arm and tried several, but these have then led to allergic reactions on my skin, which is why I then had to switch back to test strips."*

Like mentioned above the desired result of eHealth platforms from all Type 1 Diabetes patients Interviewees are a constant overview and monitoring of one's individual blood sugar level. The overall goal that results from this is a better long-term value and a better life quality in general. *"[...] I think, the main reason why I switched in the first place was that it allows you to check your values more often, which gives you better control over your blood glucose levels. And that is of course also healthier."*.

4.3 User experience

These results were indicated through eight Interviews with Type 1 Diabetes patients.

4.3.1 Personalization

All Interviewees stated that their health monitoring device and its platform met their demands they had before using it for the first time regarding their blood sugar level and long-term value. Whereas most of the interviewees are satisfied with their current platform and the application seven out of eight patients switched their platform at least once to find the best fitting one. Around two patients complained about allergic reactions on their skin due to the glue of the sensor. The company had no solutions for that, so those affected needed to switch the manufacturer and company. One Interviewee did even switch from an eHealth platform, consisting of a sensor, a transmitter, and a receiving app to test strips with, which the patient has to measure the glucose level manually. This person explained that one of the reasons why he avoids continuous blood glucose monitoring platforms is that the values are not accurate enough and are delayed. Also, eHealth platforms do not meet his demands considering his style of living: *"[...] I also would like to tear off my clothes and then just jump into the sea or somehow take a quick shower or do some sports. And of course, you cannot do that with such pumps or with such sensors [...]"*

4.3.2 Aesthetics

The aesthetic and usability of eHealth platforms was perceived in various ways. Three participants stated that the company of its platform offered an introduction course to learn how to engage with the service and to elaborate all features. Furthermore, two got an introduction from its diabetes practitioner and the other patients taught themselves how to use the service. Like already mentioned in 4.2.1 seven Interviewees switched the company of one's platform. One Interview stated that he first used a platform, which was recommended to him by his diabetologist then tried another service but then switched back to his original platform. The reason was the user-friendliness and the difficulty level of usability. But all respondents are very happy with the usability of their current platform. One Interviewee stated: *"[...] That this device is user-friendly. That was also very important for me because I can't do anything with systems that are complicated. And my current platform is really easy to use"*. However, all

respondents already had at least one experience with a factor that prevented them from using the platform. For example, failure of the insulin pump, or malfunction of the device with wrong blood sugar values.

4.3.3 Perceived time
The time the Interviewees are engaged with the application of the platform varies between 15 and 30 Minutes. All eight patients were satisfied with the time they are busy using the platform and had no complaints. One patient who used normal testing strips before their current eHealth platform mentioned that when comparing both platforms that the time of application of the continuous blood glucose monitoring systems is less: *"It has definitely become much less, as it used to take me much longer with the test strips"*. Every seven or ten days the sensor needs to be exchanged, which also takes only a couple of minutes. Here, no complaints were mentioned either.

4.3.4 Trust in government
All eight Interviewees stated in the conversation that they do not have any fear about their personal data being in the hands of the government. Furthermore, they do not fear
any lack of security or threatened by the Cloud, where all information conducted by the sensor are stored. Several Type 1 Diabetics explained that they do not know what kind of usage the government would have for their blood sugar values and mentioned that the user's advantage of the platform is way greater than for the state. One stated: *"And I think my benefits from using it are greater than the fear of the government putting my blood sugar readings online."*. Three Interviewees also expressed that they see only benefits with sharing their data in the Cloud, since it can help the patient in emergencies or daily life. For example, diabetologists or family members can have access to the Cloud and can scan one's blood sugar. *"[...] because I think it makes the process easier for the doctor and the clinic. For example, if I have to go to the diabetes clinic, it is possible to read my values directly"*. But there is still trust in the government.

4.4 User engagement
All eight diabetics stated in their Interviews that they are depended on their health monitoring devices, and it would be impossible to life without it. In order to live a life without any drastic negative effects due to the chronical illness a daily interaction needs to take place. One Interviewee said in the conversation: *"[...] that means you are naturally dependent on those platforms. If one fails, then of course the likelihood is that you will be hypoglycemic and not be supported by the platform and this can end bad."*

There were multiple processes mentioned in the eight Interviews of how the patients got to engage with their platforms. The first way how awareness got created was through diabetologists who introduced the patient to platforms, two Interviewees stated that they engaged with the platform because a friend recommended a platform, and another was through commercials of the manufacturer. The diabetologist stated that eHealth platform organizations heavily promote their products to gain a high direct engagement between human and device. *"They also do their own advertising. They try to make sure that every patient or every diabetic gets this device."*.

Like already mentioned in previous result sections did seven Interviewees already disengaged with a platform and engaged with another better fitting on. One Interviewee also reengaged with his first eHealth platform because of the usability. Another

Interviewee also disengaged with multiple platforms to then go back to test strips.

Lastly, all interviewed diabetics explained that they would be open to also engage and interact with another platform or device, if all factors would fit with their needs and demands and if new features for the patients advantage would be introduced. *"Well, I'm open for a change. Especially because there's a lot going on regarding the technology. If something significantly better were to come onto the market"*.

5. Discussion
In this chapter the findings from 4.1, 4.2, 4.3 and 4.4 will be analyzed and discussed, while linking this information to the theoretical framework in 2.1, 2.2 and 2.3. This study aims to generate the role of value proposition in the user engagement of effective eHealth platforms in the case of Type 1 Diabetes patients. Through the analysis, which process is described in 3.1, 3.2 and 3.3. the outcomes of the interviews will be further investigated in this section to later on answer the research question of this paper.

The results show a strong correlation between value proposition and user engagement with relation to the user experience (Figure 2). Analyzing the results, it was identified that a matching value proposition map and customer profile creates a positive user experience. Here, four different components were evaluated, which are personalization, aesthetic, perceived time, and trust in government. If all four were perceived as value gaining patients stayed loyal to the platform and the interaction and user engagement increased. Furthermore, this analysis supports the hypothesis stated in 2.3: *"For this study it is expected that a matching value proposition map and customer profile positively influences the user experience of Type 1 Diabetes patients. If the platform shows great value and a significant experience measured by the four components mentioned above the user engagement is most likely to increase and remain steady."*.

The obtained data regarding the value proposition canvas shows a customer close platform that responds to the overall demand regarding the health of its customers. The benefits the platform promises to offer are to control the blood sugar level of Type 1 Diabetes patients, automatically taking blood samples every five minutes, and a good data storage of the patients' values. Therefore, the service offers great advantages for users. However, the output also points out that there is a lack of comprehension concerning complaints about individual problems with the service, device, or platform. It was stated that the organizations of platforms are rather profit driven and pass complaints on to customer service but improvements concerning more smaller problems are not indicated. For example, the data show several complaints about skin tolerance, but no actions followed, and the patients were forced to change the manufacturer of the platform. These results confirm the hypothesis because it shows how no matching value propositions with the users' needs and demands, which are promised by the company can negatively influence the interaction between the platform and patient. The data also validates the literature of Trawley et al. (2017), which states that that a low user engagement happens when a service offers no value for the user.

Customer close platforms and value propositions with great benefits are more likely to create higher user engagement (Kim et al., 2013). When users have personal or individual challenges with the usage there are more likely to disengage since the value propositions only refer to superficial needs and demands and

patients with unresolvable problems are almost forced to switch the platform and to reengage. Moreover, more than half of the participants stated that they already disengaged with an eHealth platform at least once. Figure 2 shows factors influencing the degree of user engagement. When at least one of those components do not match a higher chance of disengagement exists, which the number of changes within the manufacturer of a platform shows. Osterwalder (2015) express that the perfect customer close platform occurs when each block of the value proposition canvas balance each other out. In appendix D the characteristics of the value proposition map and customer profile are illustrated using a table. Comparing each side, it can be stated that most health monitoring platforms of the Interviewees offer customer close services because the most striking needs and demands of users are met within the usage of these platforms. For example, the most striking advantages most patients expected from the platform was a consistent overview over their blood glucose level and these platforms are offering this demand.

The four components of user experience show a clear relationship towards the interaction and engagement with the used health monitoring eHealth platforms. Literature states that a positive experience with a platform is likely to increase the engagement (Chen et al., 2021). All patients are depended on a device to prevent any negative consequences due to an unbalanced blood glucose level. However, the data showed that in nearly all cases negative experiences with the platform led to a falling number of interaction but all except of one participant kept using an eHealth platform but from another manufacturer and one even changed to manual test stripes due to difficulties with the sensor. In line with the hypothesis the results show that when the user experience was perceived as positive the interaction and engagement stayed steady and even increased since then it was most likely that a recommendation to other patients was made. Nevertheless, the results show that no participant mentioned the components *trust in government* and *perceived time* when they were asked about their demands towards their platform. The main requirements for patients to use the service is the useability, adaptability, and technical features. Therefore, the results contradict the claims of section 2.3 that all for components: *Personalization, aesthetics, perceived time, and trust in government* play an essential role for an increasing engagement. Better it can be stated that *personalization* and *aesthetic* are the only two components, which influence the user experience followed by the customer engagement. During the analysis no particularly striking unexpected results were noted since most results confirm the in 2.3 indicated hypothesis.

6. Conclusion

The goal of this study is to answer the following research question: *"How do value propositions influence the user engagement of eHealth platforms for Type 1 Diabetes patients?"*. In order to answer this question three sub-questions were looked into.

The first sub-question *"How is value proposition defined in existing literature?"* has been investigated in 2.1. Therefore, literature had been examined by the authors Osterwalder et al. (2015), Kim et al. (2013), Hassan (2012) and Joyce and Paquin (2016). The result is that value proposition describes the benefits a user can expect from a service. Furthermore, a customer close service is created when the advantages a platform (value proposition map) offers meets the user's needs and demands (customer profile).

The second sub-question *"How is user engagement defined in existing literature?"* has also been answered with the help of

literature. Here, the papers of Brodie et al. (2011), Hollebeek et al. (2019), O'Brien and Toms (2008), Llamas et al. (2014) and Kim et al. (2013) had been analyzed. User engagement can also be called customer engagement and is about the interaction between a brand and a person using this service or product. The process of engagement can be divided into four phases: 1. Point of engagement 2. Reengagement 3. Engagement and 4. Disengagement and can be used to create a great user experience.

Thirdly, the last sub-question *"What is the relationship between value proposition and user engagement?"* was answered through existing literature and linking together all concepts, which were found in valuable papers. It was investigated that value proposition and user engagement and linked with the concept of user experience. The benefits of a service decide whether the user experience is perceived as positive or negative. And these opinions of users are relevant for the engagement. If the user experience is recognized as value gaining the customer is more likely to stay loyal to the company but if the experience is perceived as rather negative a higher chance of disengagement exists.

The research question of this paper: *"How do value propositions influence the user engagement of eHealth platforms for Type 1 Diabetes patients?"* has been answered by qualitative research in form of multiple interviews. Afterwards, the results of these Interviews had been linked to the concepts described in the theoretical framework. This paper suggests that value propositions influence the user engagement of an eHealth platform via the concept of user experience (Figure 2). Besides this, A user-close service keeps the engagement study or even increase it and no matching value propositions decrease the user engagement. It was found that two components of user experience showed no relationship with user engagement. Figure 3 shows the new indicated relationship between the three concepts.
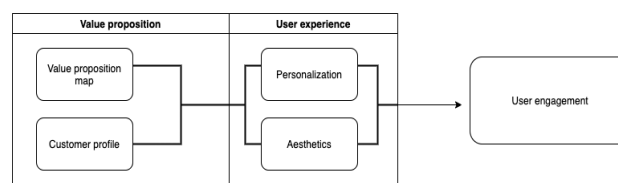

Figure 3. Influence of value proposition on user engagement

7. Limitations

Limitations were tried to be minimized during this study, but some still occur. Firstly, the most striking limitation is the timeframe this paper had to be finished in. Due to the limited time only nine Interviews were conducted and analyzed. This confined the generalizability of the applied concepts regarding the role of value proposition in the user engagement of eHealth platforms for Type 1 Diabetes patients. Additionally, only one general practitioner was interviewed as a representative for companies of blood glucose monitoring platforms. That is why a purposive sampling approach was used to gather valuable data from affected people to achieve valid results. A second limitation is the bias that could occur in Interviews. It may happen that writers of interview questions intentionally or unintentionally steer the interview towards a specific outcome. The third limitation is the living location of the participants. All interviewees were born and are still living in Germany. Therefore, a generalization of all Type 1 Diabetics is not possible with the sample of this study. It might be that the perceived view on certain factors varies within other countries.

8. Acknowledgements

9. References

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Appendix A – Interview introduction

Hallo und danke, dass Sie sich die Zeit nehmen dieses Interview mit mir zu führen. Mein Name ist Gina Fleiter und studiere im dritten Jahr International Business Administration an der University of Twente. Das Thema meiner Bachelorarbeit lautet: "Die Rolle des Wertversprechens bei dem Nutzer Engagement effektiver eHealth-Plattformen für Patienten mit Typ-1-Diabetes". Dabei gehe ich unter anderem auf die Bedürfnisse und Forderungen der Kunden ein und wie die Interaktion zwischen Plattform und Nutzern die Effektivität beeinflusst.

Bevor wir beginnen, möchte ich Sie um Ihre Einwilligung bieten, dass Interview aufnehmen zu dürfen. Nur ich werde Zugriff zu der Aufnahme haben und werde sie sofort nach der Bearbeitung der Analyse löschen. Dieses Interview ist freiwillig, deswegen haben Sie jederzeit die Möglichkeit die Befragung abzubrechen. Ihre Antworten werden keinerlei Konsequenzen mit sich ziehen. Persönliche Daten wie zum Beispiel Ihr Name werden nicht geteilt. Sollten Sie Fragen zum Interview haben, können Sie diese selbstverständlich zu jedem Zeitpunkt einbringen.

Appendix B – Interview questions template for the practitioner

<u>Value proposition</u>

- Welche Aufgaben erfüllen Blutzuckermessgeräte/Sensoren für Diabetes Patienten?

- Was versprechen die Hersteller der Plattformen Ihren Nutzern?

- Welche Vorteile bietet diese Geräte den Nutzern?

- An welchen Faktoren messen Sie die Effektivität eines Service?

- Wie schaffen die Hersteller einen Kundennahen Service?

- Wie gewährleisten die Plattform einen hohen Wert für die Benutzer, so dass die Patienten den Service gerne nutzen?

- Akzeptieren alle Kunden die Art der Anwendung der Blutmessgeräte?

- Wie gehen Sie mit Patienten um die, die neuen Technologie nicht akzeptieren oder nicht damit umgehen können?

- Was sind die häufigsten Beschwerden der Nutzer, wenn Sie diese Services benutzen?

- Gibt es Patienten, die nach erster oder längerer Anwendung der Pattformen diese wieder abbrechen?

- Warum brechen manche Patienten die Anwendung des Service ab?

- Welche Faktoren fließen in die Entwicklung neuen Modellen der Geräte?

- Wie gehen Sie und die Hersteller der Plattformen mit sinkenden Nutzerzahlen um?

Appendix C – Interview questions template for Diabetes patients

<u>Value proposition</u>

- Was benutzen Sie, um Ihre Gesundheit zu überwachen?

- Was waren Ihre Anforderungen an die Plattform vor der ersten Nutzung?

- Welche Faktoren könnte Sie daran hindern die Plattform zu verwenden?

<u>User experience</u>

- Wie lange sind Sie ca. am Tag mit der Bedienung der Plattform beschäftigt?

- Haben Sie Angst um Ihre persönlichen Daten, die in der Empfangsapp gespeichert werden?

- Inwiefern hat sich Ihre Gesundheit durch das Gerät geändert?

- Haben Sie die neue Technologie sofort verstanden und akzeptiert?

- Wenn nein, was fiel Ihnen schwer zu verstehen?

- Was würden Sie sich für Verbesserungen an den Plattformen wünschen?

User engagement

- Wie lange benutzen Sie die Plattform schon?

- Wie sind Sie auf das Blutzuckermessgerät aufmerksam geworden und wer hat Ihnen die Technology und Anwendung erklärt?

- Werden Sie die Plattform auf lange Sicht weiter benutzen?

Appendix D – Overview results value proposition

Value proposition map				Customer profile	
Product	Gain creators	Pain relievers	Jobs	Gains	Pains
Physical / Digital	Accurate blood glucose values	Better control over health	Functional job	Control over health; better long-term values; access of others	Functional pains: technical malfunctions; allergic reaction

Appendix E – Overview results user experience

	Personalization	*Aesthetic (of current platform)*	*Perceived Time*	*Trust in Government*
Interviewee 1	Allergic reaction from previous device; current meets almost all needs and demands	Very good; introduction course; already switched platform	18 minutes	Yes
Interviewee 2	Allergic reaction from previous device; current meets almost all needs and demands	Good; a lot of Data; already switched platform	30 minutes	Yes
Interviewee 3	Current platform meets almost all needs and demands	Very good; introduction course; already switched platform	15 minutes	Yes
Interviewee 4	Current platform meets almost all needs and demands	Very user friendly; already switched platform	30 minutes	Yes
Interviewee 5	Current platform meets almost all needs and demands	Very good; Introduction course; already switched platform	30 minutes	Yes
Interviewee 6	Current platform meets almost all needs and demands	Good; already switched platform	15 minutes	Yes
Interviewee 7	Current platform meets almost all needs and demands	Very good; already switched platform	15 minutes	Yes

Appendix F – Overview concepts and literature reference

	Definition	Literature
Value proposition	*"A customer value proposition (CVP) is a strategic tool that is used by a company to communicate how it aims to provide value to customers."* (Payne et al., 2017)	Osterwalder, A., Pigneur, Y., Bernarda, G., & Smith, A. (2015). Value proposition design: How to create products and services customers want (Vol. 2). John Wiley & Sons. Joyce, A., & Paquin, R. L. (2016). The triple layered business model canvas: A tool to design more sustainable business models. Journal of cleaner production, 135, 1474-1486.
User experience	*"Service experience is an actor's subjective response to or interpretation of the elements of the service, emerging during the process of purchase and/or use, or through imagination or memory."* (Jaakkola et al., 2015).	Chen, T., Guo, W., Gao, X., & Liang, Z. (2021). AI-based self-service technology in public service delivery: User experience and influencing factors. Government Information Quarterly, 38(4), 101520. Sandström, S., Edvardsson, B., Kristensson, P., & Magnusson, P. (2008). Value in use through service experience. Managing Service Quality: An International Journal.
User engagement	*"The concept of "direct engagement" emphasized the interaction between human and machine, whereby the users' cognitive intentions could be realized through the physical manipulation of the interface."* (Lalmas et al., 2014).	Brodie, R. J., Hollebeek, L. D., Jurić, B., & Ilić, A. (2011). Customer engagement: Conceptual domain, fundamental propositions, and implications for research. Journal of service research, 14(3), 252-271.

Appendix G – Overview application continuous glucose monitoring devices