

Adapting a nutrition chatbot to the user's nutrition and food literacy

A thesis project for the master degree of
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Abstract

Eating healthy is crucial to maintaining good health and avoiding diseases. Within the technology field, many nutrition applications and chatbots have been developed to promote healthy eating. However, the latter still faces a few challenges regarding user engagement. Users of low Health Literacy tend to be less engaged in using health chatbots as they do not understand medical terms that well. Moreover, there is little research about the Nutrition and Food Literacy (N&FL) of the user. In our study, we assessed the N&FL of the user with the Nutrition Literacy Scale (NLS) and developed a nutrition chatbot. The chatbot adapted its text on numeracy, vagueness and wording and provided nutrition reports. We conducted a within-subject experiment with 22 participants divided into two groups, adaptive and non-adaptive, that interacted with the equivalent chatbot.

We measured user engagement using quantitative methods. No significant differences were found between the groups as all participants followed similar engagement behaviour. However, this increased when push notifications were sent as reminders. In addition, we conducted seven interviews to measure user satisfaction and if they gained any new knowledge. The adaptive group was identified with a higher interest in nutrition than the non-adaptive, leading to lower satisfaction because of higher expectations from the chatbot. No one expressed any knowledge gain, but rather they gathered more insights into their daily diet. Finally, the textual content analysis showed that each group had different interests in their questions. Although our experiment did not have significant results, we believe this study gives new insights into a topic that has not been studied as much, namely adapting a nutrition chatbot to the user's interests. We suggest that future work focuses on this direction. Due to the limitations of our study, we also propose repetition of the experiment with a more diverse sample in N&FL and a different N&FL assessment tool.

Keywords: nutrition; chatbot; NLG; text-adaptation; nutrition & food literacy; behaviour change;

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Acronyms

AI	Artificial Intelligence.	9–11, 16
ANLG	Affective NLG.	2, 7, 8, 15, 16, 20, 44
CA	Conversational Agent.	5, 9, 17
EFSA	European Food Safety Authority.	8
FL	Food Literacy.	5, 12, 13, 25
GUI	Graphical User Interface.	16
HL	Health Literacy.	1, 5, 7, 11, 12, 17, 21
LMM	Linear Mixed Models.	30
MFP	MyFitnessPal.	2, 11, 19, 23, 26–29, 38, 39, 41
mHealth	mobile Health.	5, 9, 10, 46
N&FL	Nutrition and Food Literacy.	1, 5–8, 13, 17–26, 29–31, 36, 40, 42–46
NL	Nutrition Literacy.	5, 12, 13, 25, 43
NLG	Natural Language Generation.	1, 7, 8, 13–15, 18, 19
NLP	Natural Language Processing.	16, 17
NLS	Nutrition Literacy Scale.	1, 3, 13, 25, 26, 29, 43, 44, 54
UCD	User Centered Design.	16
UES	User Engagement Scale.	27
UI	User Interface.	2, 19, 23, 27
USDA	U.S. Department of Agriculture.	8
UX	User Experience.	16, 23
WHO	World Health Organization.	8

1 Introduction

"Let food be your medicine and medicine be your food" goes back to Hippocrates, the father of medicine. Although thousands of years old, this quote recognizes the importance of a healthy diet and how the nutrients in various foods have healing properties. A healthy lifestyle with good nutrition is vital to maintaining good health and preventing disease.

Despite the known link between dietary patterns and disease, general interventions to alter dietary habits and improve health and wellbeing have limited impact. On the contrary, personalization of interventions is more effective in changing behaviour [1, 2]. However, to achieve behaviour change, we need to apply more and more dimensions or characteristics to personalization. For example, a personalized intervention could take into account age, gender, or health status.

Within the technology domain, many nutrition applications have been developed, where, acting as interveners, their objective is to promote healthy dietary patterns and, eventually, behaviour change. They achieve this by food logging, calorie counting and providing nutrition reports. In most cases, those applications recognize the importance of personalization and consider physical characteristics, dietary constraints, and user preferences when providing nutrition reports.

Lately, messaging platforms, such as Facebook Messenger and WhatsApp, have increased in popularity, and users tend to spend more time chatting than using other applications. Additionally, users have shown increased engagement and usage time for the chatbots compared to conventional diet apps. Because of that, research in mobile Health (mHealth) has focused on chatbots and Conversational Agent (CA), which act as virtual coaches providing nutrition advice. However, nutrition chatbots still face plenty of unaddressed challenges [3].

1.1 Research Problem & Questions

One of the challenges in designing a nutrition CA relates to user engagement, and as recent studies proved, low Health Literacy (HL) and language style seem to impact user engagement [4–6]. Nevertheless, HL is a broad term, and because of that, there are more specific terms for nutrition, namely Nutrition Literacy (NL) and Food Literacy (FL).

Motivated by these findings, in our study, we deepen into the Nutrition and Food Literacy (N&FL) of the user on a nutrition chatbot. In particular, we assess their N&FL and develop a nutrition chatbot, which adapts its text and provides nutrition recommendations. Adjusting to Egede *et al.*'s research, we measure the user's engagement [4]. In addition, similarly to another study [5], we measure user satisfaction too. We follow a mixed approach, using quantitative methods for user engagement and qualitative methods for user satisfaction. The results of the experiment we conduct answer the following research question:

RQ₁: How do different levels of N&FL influence user engagement and satisfaction when interacting with a nutrition chatbot?

From the above research question, we derive the following hypotheses:

H₁: User engagement will be higher in the adaptive ¹ than the non-adaptive nutrition chatbot.

H₂: User satisfaction will be higher in the adaptive than the non-adaptive nutrition chatbot.

H₃: Users of low N&FL level will have higher engagement than users of high N&FL level when interacting with an adaptive nutrition chatbot.

H₄: Users of low N&FL level will have higher satisfaction than users of high N&FL level when interacting with an adaptive nutrition chatbot.

We expect the first two hypotheses to be true. Such a case is because the chatbot adapts to the user’s comprehension. Hence, it is easier and more pleasing to use than in a case where the chatbot does not adapt at all.

Similarly, for *H₃*, we expect that user engagement will be higher for users identified with low N&FL compared to users with a higher level of N&FL. The latter ones already have good knowledge about nutrition. Consequently, we believe that they will not engage using the chatbot as much as lower levels. Nevertheless, contrary to Egede *et al.*’s findings, we expect that user satisfaction will be higher for low N&FL level users (*H₄*). Unlike theirs, our chatbot is not embodied. These usually include other social cues (body language, facial expressions and others) and could have influenced their results.

Apart from that, we expect that users with low N&FL level will increase their knowledge about nutrition over time. For that purpose, we aim to answer the following research question too:

R₂: Does the user’s knowledge change when interacting with a nutrition chatbot?

From this secondary research question, we derive one additional hypothesis:

H₅: The knowledge of a user with a low level of N&FL will increase when interacting with an adaptive than a non-adaptive nutrition chatbot.

As we explained above, high N&FL level users already have sufficient knowledge; hence, it is no interest to explore this condition further. By focusing on the low N&FL level users, we aim to find out if an adaptive chatbot could be

¹From now on, we refer to the adaptive nutrition chatbot as a chatbot adapting its text to the N&FL of a user. A non-adaptive offers a more neutral text.

used to help them improve their knowledge about nutrition.

Finally, we use Affective NLG techniques for text generation in the chatbot to enhance user engagement.

1.2 Aims of Study

On a first level, this study aims to test if user engagement and satisfaction are increased when using a nutrition chatbot. By distinguishing levels of Nutrition and Food Literacy, we aim to determine if it influences their engagement and satisfaction. In addition, our goal is to increase the gained knowledge of low N&FL level users.

On a second level, we believe that users will progress in understanding nutrition over time by providing more comprehensible recommendations. In other words, such a solution could improve people’s N&FL, leading to better decisions and improving their diet in the long term. Additionally, we believe that this research will contribute to proving that N&FL is important when implementing a chatbot and should always be taken into account when doing so.

1.3 Outline

In the following section, we dive into some of the most critical aspects of this research. We describe why nutrition is essential when following a healthy lifestyle and look into some of the most recent nutrition chatbots developed. Afterwards, we distinguish Nutrition and Food Literacy from the general Health Literacy and explain its importance in doing that. In subsection 2.4, we look into the most important components when developing a chatbot from the NLG aspect. In addition, we explain how Affective NLG (ANLG) is related to personalisation and behaviour change. In the end, we address some of the current challenges when building a chatbot and how all the previously mentioned knowledge led to our current research.

In section 3, we provide technical details of the chatbot we developed, including its architecture and choices made regarding the adaptation. Later, in section 4, we give insights into the methodology approach we followed. We explain the design, the tools we used, and the procedure. In section 5, we present the experiment’s results.

We conclude this paper by discussing the outcomes and limitations of this study.

2 Literature review

For this study, we followed a scoping literature review. Once we defined the research scope, nutrition chatbot, we used Google Scholar to search the extant literature. Using research from Balloccu *et al.* and Fadhil & Gabrielli, we identified the main gaps in this field, which led us to our research questions [7, 8].

Afterwards, we identified the main components: nutrition, chatbots, Nutrition and Food Literacy, and NLG. For each, we searched for relevant information on Google Scholar as well. While we examined its subject separately, other key concepts such as diet chatbot technologies and ANLG occurred. For each of these, we searched for relevant papers covering the prior knowledge needed for our study. In the following sections, we present our findings.

2.1 Nutrition

We spend approximately 4.5 years of our lifetime eating [9]. Every day, we make food choices that impact our health both short term and in the long run. As studies have shown, bad eating habits during childhood can lead to the development of diseases such as obesity, diabetes, high blood pressure, and others in adulthood [10, 11]. However, even if we realize the effect of food habits in our lives, there are multiple reasons for our food choices. Personal preferences, culture, social interactions, allergies, and availability are only some that impact our food habits [12]. To add to that, marketing and new food trends have led to increased variations in diets depending on the person’s goals. For example, for years, the Mediterranean diet has been considered the best for weight loss [13], until paleo, intermittent fasting, and others became popular too.

Nevertheless, the biggest challenge is combining food choices with good nutrition, and this does not involve any particular diet. Rather, it means prioritizing our health by fueling our bodies with nutrient-rich foods. The World Health Organization (WHO) divides these essential nutrients into two categories: micronutrients and macronutrients [14]. Micronutrients are nutrients that a person needs in small doses and consist of *vitamins* and *minerals*. Although the body only needs small amounts of them, a deficiency can cause ill health. On the other side, macronutrients are nutrients that a person needs in larger amounts and include *water*, *protein*, *carbohydrates*, and *fats*.

As mentioned earlier, culture impacts our eating habits, and due to it, there are no nutritional guidelines that fit all countries or individuals. For instance, the U.S. Department of Agriculture (USDA) suggests consuming 10-35% of protein, 45-65% of carbohydrates, and 20-35% of fat from the daily energy intake for active adult individuals [15]. On the opposite, India’s nutritional guidelines propose 50-60% of carbohydrates, 20-30% of fats, and much less protein intake (10-15% of total daily calories) [16]. Similar to India’s macronutrient values, in Europe, the European Food Safety Authority (EFSA) suggests a lower protein intake percentage (12-20%) but accepts USDA’s reference intake on carbohydrates and fats [17]. The wide range between those percentages is because

physiological characteristics such as age, gender, and weight also influence our daily nutrient needs. Hence, it is sensible to believe that personalized nutrition advice is crucial for health improvement.

2.2 Nutrition Systems

Personalized recommendations based on diet are more effective than general population-based recommendations at modifying health-related behaviour change [1]. Due to that, many health and nutrition applications have been developed to provide personalized nutrition advice and promote healthy eating in the past years. However, the effectiveness of these mHealth apps has been controversial. Lee *et al.* conducted a review on 12 mHealth apps, four of which focus on nutrition [18]. Their results were positive, as most of the apps achieved their goal of improving diet and physical activity. Their article also suggested techniques for further user engagement, such as setting alarms and notifications. Another proposal was to promote social interaction with collaboration or friendly competition among the users. Finally, they found that enhancing a mobile app’s entertainment element could also assist intervention efficacy. Rather than merely providing information, an app could introduce games or quizzes to help people remember their health information and improve their learning.

Apart from the above, McCarroll *et al.* in 2017 conducted a systematic review of 23 articles about the use of mobile apps to promote healthy eating [19]. Their results indicated minor positive effects on healthy eating and weight loss. As the authors discuss, this was because the studies were mainly of poor quality, including homogeneous samples (overweight or obese adults living in high-income countries), mostly trial studies on mHealth or studies with short duration. Hence, they argued that the results could not be considered adequate.

In agreement with these unsatisfactory results, a third scoping review in 2019 concluded that most apps focus on the practical aspects of the mHealth apps. The authors claimed that the apps dive less into explaining the causal links between the tool’s components, the individual’s characteristics and the environment of use. Finally, they discuss an apparent lack of considering social qualities, as well as the literacy level of the users [20].

2.2.1 Health Chatbots

So far, we have discussed the effectiveness of mHealth apps only. However, recent research has focused on chatbots and Conversational Agent (CA) because of their natural interaction flow, and user-friendliness [7]. Chatbots have come a long way from being very restrictive at the beginning. Nowadays, thanks to the revival of AI, they have reached the level of using neural modelling and being able to converse for rich topics, from booking appointments to political speeches [21].

Among their benefits are personalization, asynchronicity, authentication, anonymity, consumability and scalability [22]. In a health context, they can

be helpful as they can, for example, provide personalized diet and healthy eating tips to people with diabetes (personalization). Chatbots can also provide help without synchronous communication with a specialist (asynchronicity). As far as authentication and anonymity are concerned, they offer identity verification or the option to use them with an anonymous profile. Consumability-wise, chatbots outperform previous technologies as they are considered readily "consumable". In most cases, they have easy installation and are independent of the platform. In addition, chatbots have the potential to target large audiences in a cost-effective way (scalability).

In the long run, health chatbots can assist users in adopting a better lifestyle and changing their behaviour rather than the more traditional approach of assisting users in conducting a task [22].

2.2.2 Diet Chatbots

As we mentioned, mHealth chatbots are an emerging technology, and many researchers follow different solutions when developing them. In the following paragraphs, we describe some of them emphasising in diet chatbots.

In 2017, Fadhil & Gabrielli proposed a diet chatbot but focused mainly on its technical implementation [8]. The chatbot discussed aims to achieve healthy eating habits and personalised support. Another interesting feature was tracking the user's sentiment. The idea was that the bot would collect emotional data about users to understand their mental mood condition at a particular stage during their behaviour change process. Such a condition is relatively attractive as recent research showed that stress affects how a person perceives nutrition recommendations [6].

Similarly, in 2018, Gabrielli *et al.* developed SLOWBot, which guided the participant to make informed and enhanced health decisions making, specifically around food choices [23]. For instance, when there was a recommendation to eat avocado, the chatbot proposed to take organic as they were proven to be 'non-dirty' food. However, this chatbot was just a proof of concept, and there has been no update since then.

Another more promising solution was the SWITCH app. Developed by Huang *et al.* it combined a mHealth app with a chatbot integrated into it [24]. The user could input his food intake and exercise. Upon start-up, individuals were guided through a sequential process of goal-setting. In addition, the SWITCH mobile app encouraged individuals to set a weight-loss target. The chatbot could help monitor users' health. Apart from that, users could talk to the health chatbot and get the information in real-time or take a bot's advice, such as diet and exercise plans, in the context of healthy recommendations. SWITCH app differed from researcher-controlled and commercial apps in that it was guided by valuable feedback from an experiment group. It also contained features to enhance usability, such as a function allowing users to conduct a conversation with the SWITCH app through auditory or textual methods. Another feature was the AI-powered health chatbot to provide customised support (e.g. diet and exercise tracking and advice, eating tips, proactive weight prediction,

eating order) and other information (e.g. nutrient intake recommendations, physiological measurements).

In 2020, Prasetyo *et al.* developed another chatbot – Foodbot [25]. Its solution is interesting because it dealt with problems such as food logging that conventional apps like MyFitnessPal (MFP) have. Foodbot utilised automatic speech recognition and mobile messaging interface to record food intake. Its behaviour change design followed standard techniques [26], such as goal and planning and feedback and monitoring. However, it did not consider any nutritional values. Instead, it followed evidence-based dietary guidelines; for example, a fish intake goal is at least two servings per week, a water intake goal is about six-eight glasses per day, and others. In addition, Foodbot was considered better compared to other chatbots such as CoachAI. As the authors mention, CoachAI operated as a telemedicine platform, utilising a chatbot as a front-end user interface for monitoring and delivering, thus requiring full supervision from healthcare practitioners.

To sum up, in the past years, many diet chatbots have been developed. Focusing primarily on the technical implementation, the solutions include speech and sentiment recognition or a combination of an AI chatbot with a nutrition app to optimise results. However, there are still many unaddressed challenges, which we discuss further in subsection 2.5.

2.3 Health Literacy

Health Literacy as a term was first used in a 1974 paper titled "Health education as social policy" [27]. In discussing health education as a policy issue affecting the healthcare system, the educational system, and mass communication, the author called for minimum standards for "health literacy" for all school grade levels. Nowadays, *HL* refers to "the degree to which individuals can obtain, process, and understand basic health information and services needed to make appropriate health decisions" [28].

In 2013, in an attempt to strengthen Health Literacy in Europe, Kickbusch discussed some interesting facts [29]. Limited HL was associated with less participation in health-promoting and disease detection activities and riskier health choices such as higher smoking rates. There was also diminished management of chronic diseases (such as diabetes, HIV infection and asthma), poor adherence to medication, increased hospitalization and rehospitalization, and increased morbidity and premature death.

In support of these facts, research in 2017 in the US proved a positive correlation between low Health Literacy levels and poor diet [30]. In particular, Health Literacy was a significant predictor of diet quality based on total micronutrient intakes. The relationship between Health Literacy and diet quality was also stronger as the education level increased. Other studies have supported the latter, too [29].

Apart from being health literate, though, someone needs to understand numeracy too [31]. *Health numeracy* is "the degree to which individuals can access, process, interpret, communicate, and act on numerical, quantitative, graphi-

cal, biostatistical, and probabilistic health information needed to make effective health decisions” [32].

The importance of understanding numeracy is more evident in the US, where it is estimated that about 30% of the general population has limited numeracy. However, numerical medical information is not only presented by numbers. Graphic display formats such as pie charts, bar charts, and others can be used too. In particular, in 2020, Durand *et al.* conducted a study examining the association between numeracy, health and graph literacy. Although they were the first to study this, their results showed that graphic display formats led to higher comprehension among people of lower education [33].

As the problem of poor HL skills has been known for a few years, there is much effort to promote our health knowledge. Some of the techniques suggested [34–36], include:

1. Converting research jargon, medical terminology, and other complex terms into plain language.
2. Using visuals to interpret numbers, or keeping numbers simple, and give easy-to-understand modifiers to add meaning.
3. Removing non-essential information, in a way to emphasize the critical information,
4. Framing effectively combining numbers with explanatory phrases to enhance communication and increase trust.

However, building Health Literacy skills and abilities is a lifelong process and requires participation from many stakeholders (organizations, health care facilities, academic community, educators and others) [29].

2.3.1 Nutrition & Food Literacy

Most of the research so far has looked into the Health Literacy of the user to produce health reports that are more comprehensible [4]. However, Health Literacy is context-specific, and due to that, there have been distinct Health Literacy forms such as e-health literacy and mental literacy in the most recent years [37]. Similarly, there has been a gradual emergence of literature under the umbrella terms Nutrition Literacy and Food Literacy that explicitly focus on Health Literacy skills in a food context.

According to Silk *et al.*, *Nutrition Literacy* is defined as the degree to which individuals can obtain, process, and understand nutrition information and skills needed to make appropriate nutrition decisions. As this term is broad, many health professionals identify NL as the knowledge of macronutrient intake, food groups, nutrition concepts and food compositions, in conjunction with basic math and measurement competencies [37]. In addition, NL correlates with nutrition skills such as estimation of portion size, understanding food labels, and seeking/trusting nutrition sources [39, 40].

Likewise, *Food Literacy* is composed of a collection of interrelated knowledge, skills and behaviours required to plan, manage, select, prepare and eat food to meet needs and determine food intake [41]. Vidgen & Gallegos in their research, defined the core components of FL as depicted in Figure 1 [41].

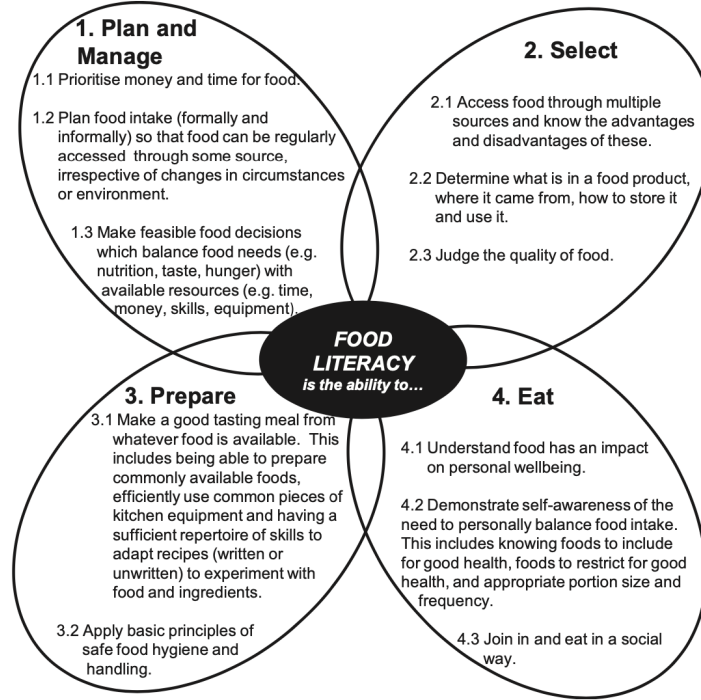


Figure 1: The eleven components of Food Literacy [41]

NL and FL are two terms interlaced and hard to define strictly. In 2018, Yuen *et al.* conducted a systematic review of 13 existing measuring N&FL tools. Some of them were NLit [43], Nutrition Literacy Scale [44] and e-NutLit [45]. The tools differed in many variables. For instance, some focused on different age groups, some on the goal of assessment, and others on the time duration. The researchers indicated that most tools assessed nutrition literacy rather than food literacy in their results. Therefore, there is no ideal assessment tool for measuring someone’s NL or FL level, and each tool can be considered valid in the right context depending on the use.

2.4 Natural Language Generation

Zooming out of the nutrition field, in this section, we focus on another aspect of this research, that of Natural Language Generation (NLG). As mentioned

before in our discussion about chatbots, they have come a long way since they were first introduced, and NLG has been an integral part of their evolution.

2.4.1 Architecture and Components of an NLG System

NLG systems combine knowledge about language and the application domain to automatically produce documents, reports, explanations, help messages, and other kinds of texts. In other words, an NLG system’s task is to map some input data to an output text. During the design process, it is helpful to decompose this task into a few more concrete substeps. In current NLG research, which increasingly relies on neural models, sometimes these tasks are not distinguished explicitly (e.g. you might not have different modules for each task). However, this list of subtasks is still helpful as a “logical” description of what text generation entails. Here, we present six basic subtasks that need to be done to produce a final output text [46, 47], as consented by the NLG community throughout the years.

1. *Content determination*: Deciding which information to include in the text under construction,
2. *Text structuring*: Determining in which order information will be presented in the text,
3. *Sentence aggregation*: Deciding which information to present in individual sentences,
4. *Lexicalisation*: Finding the right words and phrases to express information,
5. *Referring expression generation*: Selecting the words and phrases to identify domain objects,
6. *Linguistic realisation*: Combining all words and phrases into well-formed sentences.

NLG systems incorporate the aforementioned subtasks depending on the NLG architecture chosen to follow. A classical NLG architecture, agreed by many in the NLG community, is shown in Figure 2.



Figure 2: Classical three-stage NLG architecture. Darker segments illustrate the three main modules; lighter segments show the outputs [46]

In this pipeline architecture, the first module, Text Planner (or Document Planner, or Macroplanner), combines *content selection* and *text structuring* (or

document planning). Thus, it is concerned mainly with strategic generation [48], the choice of *what to say*. The resulting text plan, a structured representation of messages, is the input to the Sentence Planner (or microplanner), which typically combines *sentence aggregation*, *lexicalisation* and *referring expression generation* [46]. If text planning amounts to deciding what to say, sentence planning can be understood as deciding *how to say it*. All that remains then is to actually say it, i.e., generate the final sentences in a grammatically correct way by applying syntactic and morphological rules. The Linguistic Realiser performs this task. Together, sentence planning and realisation encompass the set of tasks traditionally referred to as *tactical generation*.

In the most recent years, Gatt & Krahmer conducted a survey of the current state of NLG [47]. They argue that the currently dominant trend relies on integrated or global approaches rather than modular architectures. Such approaches cut across task divisions, usually by placing a heavy reliance on statistical learning of correspondences between (non-linguistic) inputs and outputs. The authors discuss those approaches and their caveats further in detail, but we will not extend to this direction as it is not the focus of this study.

2.4.2 Affective NLG

In recent years there has been a great interest in building NLG systems that not only inform but also consider the recipient’s emotional state. This development has led to the rise of Affective NLG (ANLG), which is defined as “NLG that relates to, arises from, or deliberately influences emotions or other non-strictly rational aspects of the hearer”. These aspects (denoted by the generic term “attitudes”) include personality traits, emotions, and highly-placed values [49].

The idea is that an NLG system employs methods of this kind to “slant” a message in a particular direction rather than to present a message in a more neutral way. The purpose of it is, for instance, to induce positive emotions in a reader who needs encouragement or negative emotions in a reader who is over-confident.

Within the ANLG field, many features have been found to have an emotional impact and are about word choice, lexical alignment with an interlocutor, or controlling the tone of automatically generated text.

In particular, de Rosi & Grasso suggest that we can generate affective text through redundancy, the inclusion of motivating and reassuring details, and elusion or omission of demotivating topics [49]. Other strategies include enhancing or mitigating terms, first plural person pronouns, and adverbs.

Below, we present some sentences we extracted from a medical report shown by de Rosi & Grasso. The techniques to provoke affect are depicted in bold.

1. So, **the good news** is that we do have tablets that are **very effective** for treating TB, **you do have to take several tablets a day**, and you will have to take them for some months to **get really over** this problem
2. the problem, with this infection, is **it takes a very long time to eradicate** it from the body and therefore **we have to undertake quite a**

long course of treatment which **it is essential for you** to fulfil for the full course.

3. Now the other thing we've got to do is to look into why you've got this, **we're a little bit worried** that you're **maybe a bit undernourished**, and haven't been looking after yourself

Inclusion of motivating details (*very effective*) and use of first plural (*we have to, we're a little bit worried*) are some of the techniques used above. Additionally, as it is seen, verbs (*worried*), adjectives (*the good news*), and adverbs (*really, a little bit, maybe a bit*) convey affect too.

From the example above, we can infer the importance of affective texting in persuasion and behaviour change that can lead to healthier dietary choices. For that reason, in the following sections (see section 3), we describe how we use ANLG strategies to generate more affective texts when developing a nutrition chatbot.

2.5 Unaddressed Challenges on Diet Chatbots

Previously, we presented some recent diet chatbot applications. However, there are still many unaddressed challenges in the field. In 2017, Fadhil highlighted the main behavioural, theoretical, technical, design and logical-flow challenges associated with building chatbots, particularly within the food domain [3].

Regarding the theoretical challenges, the author argues that chatbots are rarely based on theoretical foundations and are mostly generic in the domain focus. Because of it, there is a need to create models to understand the theory behind user motivation, engagement, the perceived usefulness of the chatbot, conversation matching and cultural acceptance of the conversation time. Chatbot developers should also first look into the behaviour change techniques. To understand how to engage users with the system, we first need to define the user behaviour we intend to tackle and which behaviour techniques are associated positively with behaviour change. In other words, to improve diabetes conditions, we should promote physical activity and diet through the system.

UCD and UX design are also aspects often neglected when developing a chatbot, as the requirements differ from conventional GUIs. Focus is given to the system's usability, and because of that, it is essential to put the user first. Chatbots have specific UX requirements for how the information is presented and the means of interaction, whether text, buttons, or speech. Moreover, UX designers have to pay attention to how the bot presents the content to the user. For example, if the text is too long or the image is too small, more emphasis needs to be given to how information is represented.

Conversational AI is an emerging domain with several technical limitations. The most common ones are rule-based and easier to build. However, they are finite-state systems meaning that they are less robust and less scalable with lots of potential downside for the long term. An advanced version of them, the AI-based bots provide much more possibilities as they use Natural Language

Processing (NLP), apply some intelligence and convert that knowledge through learning into powerful decision-making capability over the long term. They can be developed using various techniques such as machine learning and neural networks to offer, for instance, personalised meal recommendations. Due to these, it is essential to keep in mind the requirements of our system and choose which bot architecture fits better when developing it.

Finally, CAs have many problems with linguistic constraints. For instance, they do not understand that the verb *eat* applies only to edible objects. A way to resolve this is by encoding restrictions to the chatbot. More intelligent methods involve using NLP and statistical techniques trained on large corpora. Chatbots should understand what the user types in and interpret it correctly.

Other major bot design and development areas include Chatbots' Personality, Flexibility in Response, Simplicity in Interaction, Tasks and Duty Specification, Empathy & Emotional State, and User Boredom, to mention a few. In our current research, we emphasise the behavioural challenges when developing a chatbot.

2.6 Towards a Nutrition Chatbot

In the previous section, we gave an overview of the main challenges the current chatbot applications face. Within the human behavioural challenges, user characteristics seem to impact comprehension and adherence to diet chatbots. For instance, in a recent study, it was found that stress directly affects the way users understand a health report. Users respond negatively to health recommendations when stressed, leading them to stop adhering to them [6].

Apart from stress, other users' characteristics have been given little to no interest in researching, such as Health Literacy and language. Regarding the latter, diet chatbots have been developed, mainly offering the English language. Nevertheless, Egede *et al.*, in their research, found differences in user engagement between people whose native language was not English and native English speakers when interacting with an embodied CA [4]. Particularly, they found that people using English as their second language were more engaged in the embodied CA. Due to that, they urge that future research looks into how English as a second language affects the user's engagement with CAs.

Another noteworthy finding was about different HL levels. The aforementioned study's primary goal was to develop an embodied CA adapting to the HL of the users. Surprisingly, their findings indicated that users identified as having low HL found it harder to interact with the CA, leading to less engagement than users of higher HL level. As the authors describe, these results contradict previous findings of Bickmore *et al.*. This study showed that low HL users preferred more the embodied CA to high HL users [50].

Even though Egede *et al.*'s study is about embodied CAs, we noticed a gap in research about HL on chatbots, as we could not find other similar studies. In addition, as we argued earlier, Health Literacy is a context-specific term. Because of this gap, we developed an adaptive nutrition chatbot that emphasises the N&FL of the user.

To this point, we have not articulated yet how NLG is involved. As previously mentioned, NLG is essential when developing a chatbot providing personalised nutrition recommendations. In addition, much interest has been given to affective texting in recent years. Because of that, we consider that developing a chatbot without using affective texting in the app would not suffice for the goals of this study. Hence, apart from adjusting to the N&FL level of the user, we applied some techniques such as redundancy, the inclusion of motivating and reassuring details, first plural person and others. From a technical perspective, we are interested in the Sentence planner module - *how to say it* of the classical NLG architecture. The tasks involved (sentence aggregation, lexicalisation, referring expression generation) are mainly about which words to use and present. In other words, they represent the tasks to take into account to accomplish affective text.

3 Chatbot Design

For the purposes of this study, we developed a nutrition chatbot. In the following sections, we provide details regarding its architecture and features as well as how it adapts to different N&FL. Finally, we provide some UI screens from the chatbot.

3.1 Chatbot Architecture

Our chatbot consisted of an Input Layer for users' input understanding, a Data Layer that extracted insights, and a Communication Layer that performed planning and surface realisation, as seen in Figure 3.

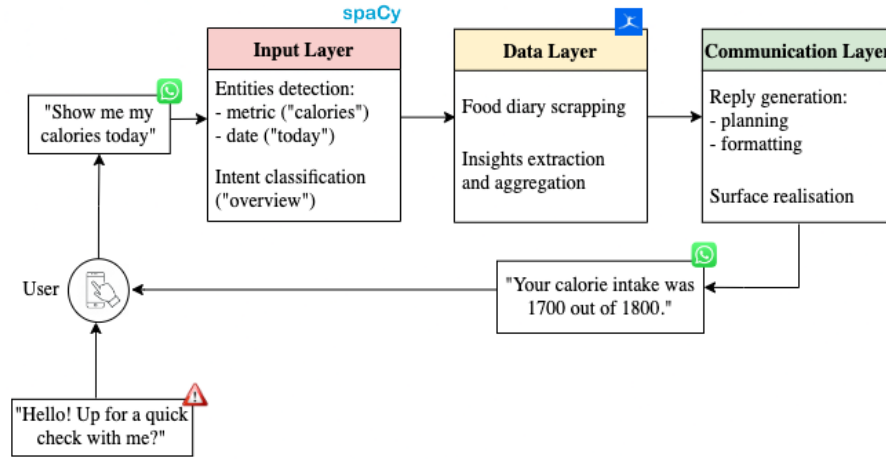


Figure 3: The chatbot's architecture and interaction flow.

We used Python 3.9 as the main setup for the entire system and the spaCy [51] library for the Input Layer. We adopted a custom data analysis logic for the Data Layer, with food diary scrapping from MFP. The Communication Layer adopted rule-based NLG.

For each request, users could specify metrics (calories or five nutrients: carbohydrates, protein, fat, sugar and sodium) and date. Based on the intent, the chatbot scrapped the user's diary data from MFP using a Python MFP API [52]. For that purpose, the user's MFP profile had to be set to "public". Reply generation and surface realisation were based on the N&FL of the user.

Communication between the user and the chatbot was established through WhatsApp using Twilio's sandbox [53], a platform that enables communication between businesses and customers.

Lastly, once connected, the chatbot sent a daily push notification at 4 pm (UTC), acting as a reminder to the users to interact with it.

3.2 Chatbot Features

The main chatbot’s features were:

1. *Inform overview*: Provides an overview of macronutrients and calories per day or for a particular date range. For example, "Show me an overview of yesterday", "Show me an overview 12-04-2022 15-04-2022".
2. *Inform specific nutrient stats*: Provides information for a particular macronutrient or calories. For example, "Show me my protein intake of last week".
3. *Inform food consumption*: Provides information regarding top/minimum food consumption. For example, "What was the food with the highest protein yesterday?".
4. *Inform extra food information*: Provides information about a particular macronutrient. For example, "Why do I need protein?".
5. *Welcome greetings*: Welcomes first-time or returning users.
6. *Goodbye greetings*: Sends a goodbye message to the user at the end of a conversation.
7. *Ask clarity*: Asks for clarification in case the user’s message was not understood.
8. *Send push notification*: Sends a push notification to remind the user to interact with it.

Features 1-4 were developed to adapt to the N&FL of the user. Nevertheless, we added some other characteristics to increase user engagement and satisfaction. For instance, it is common practice to name the chatbot in the context of a more anthropomorphic design [54]. Similarly, to mimic a more natural human interaction (as it usually occurs on messaging apps), we included the use of Emojis from the chatbot.

In addition, we used techniques of ANLG. These included redundancy and inclusion of motivating phrases. We also personalized the messages by mentioning the user’s first name and emphasizing the importance of following their personal goal.

Finally, as in Maher *et al.* ’s study, with weekly check-ins, we introduced a daily check-in too in the form of a push notification [55]. According to Freyne *et al.*’s findings, they are an appropriate way to increase engagement [56]. For that, each day at 4 pm (UTC), users received a push notification inviting them to check on their progress, as seen in Figure 4.

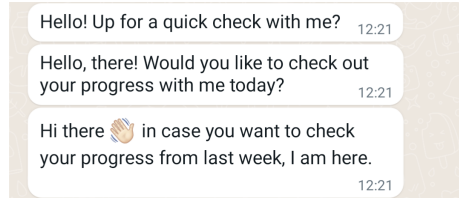


Figure 4: Participants received daily push notifications from the chatbot as reminders to check their progress.

3.3 Chatbot Adaptivity

Based on the literature review about HL and numeracy, we followed guidelines from research institutes when presenting medicine data and information to an audience [34, 35]. We decided the chatbot to adapt to three N&FL levels; Low Level, Neutral Level, and High Level ². For each, we adjusted the text based on three parameters: *vagueness*, *numeracy*, *wording*. In Table 1, we present the adaptations for each N&FL level.

Adaptivity to:	Low Level	Neutral Level	High Level
Numeracy	Text without any numerical values. Relative words are used instead (e.g., higher/lower).	Text with numerical values and relative words (e.g., higher/lower).	Text adjusted using numerical values, percentages.
Vagueness	Recommended types of food are provided.	Recommended types of food groups are provided.	Recommendations focus on nutrient names. No food examples are given.
Wording	Relatively easy-to-read text. No complex nutrition terms are mentioned.	Relatively easy-to-understand text. Nutrient names are introduced.	Relatively advanced text. More complex terms are mentioned.

Table 1: Text adaptivity based on the N&FL levels.

In continue, we created templates for each level and each feature and ap-

²More details about these on section 4.

plied them to the chatbot. An example of the template for feature 1, "Inform overview", is found in Table 2.

Low Level	<p>So the good news is that $nutr_1$ and $nutr_2$ are around the recommended intake.</p> <p>However, you should consider cutting down on $nutr_1$ and $nutr_2$, as it will not help you achieve your goal. How about eating [more/less] $foodExample_1$ and [more/less] $foodExample_2$ for a healthy diet?</p> <p>Would you like to ask something more?</p>
Neutral Level	<p>So the good news is that $nutr_1$ and $nutr_2$ are around the recommended intake. ($nutrValue_1/nutrTarget_1$ and $nutrValue_2/nutrTarget_2$).</p> <p>However, you should consider cutting down on $nutr_1$ and $nutr_2$, as it will not help you achieve your goal. How about eating [more/less] $foodGroup_1$ and [more/less] $foodGroup_2$ for a healthy diet?</p> <p>Would you like to ask something more?</p>
High Level	<p>So the good news is that $nutr_1$ and $nutr_2$ are on target. You had $nutrValue_1$ of $nutr_1$ and $nutrValue_2$ of $nutr_2$ which are around the recommended intake ($nutrValueTarget_1$ and $nutrTarget_2$ for each).</p> <p>However, you should consider cutting down on $nutr_1$ and $nutr_2$, as you had an additional $nutrValueSup_1$ and $nutrValueSup_2$ of them, and it will not help you achieve your goal.</p> <p>Would you like to ask something more?</p>

Table 2: Text template of the "Inform overview" feature.

As seen in Table 2, for users from the group of Low Level N&FL, we provided only food examples and eliminated numbers. For users from the group of Neutral

Level N&FL, we provided them with percentages and food groups instead of food recommendations. In the case of High Level N&FL, we considered that people from that group already have adequate nutrition knowledge. Hence, we provided them only with percentages and advanced vocabulary.

We used food recommendations and daily consumption intake from the MFP blog, where only registered nutritionists report. The remaining templates are in Appendix B.

3.4 Chatbot UI

Below, we present some screenshots of the chatbot UI in the production environment, where the differences between N&FL for feature 1, "*Inform overview*" (Figure 5) and for feature 4, "*Inform extra food information*" (Figure 6) are seen.

WhatsApp is ranked as the most used mobile messenger app in the world [57], and we considered it a good choice as most users are familiar with its interface. With this implementation, we did not have to consider any further UX challenges that other chatbots face.

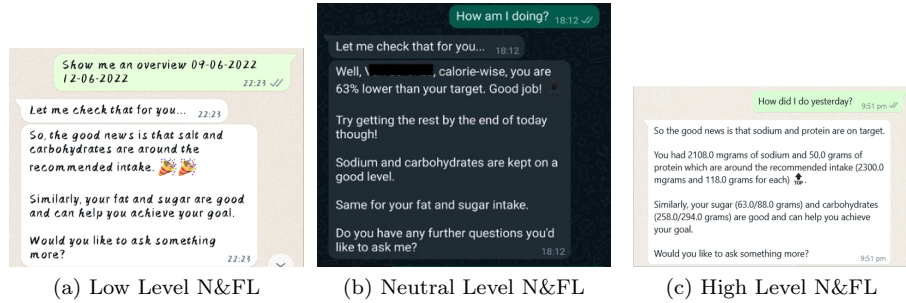


Figure 5: Chatbot UI screens of feature "*Inform overview*".

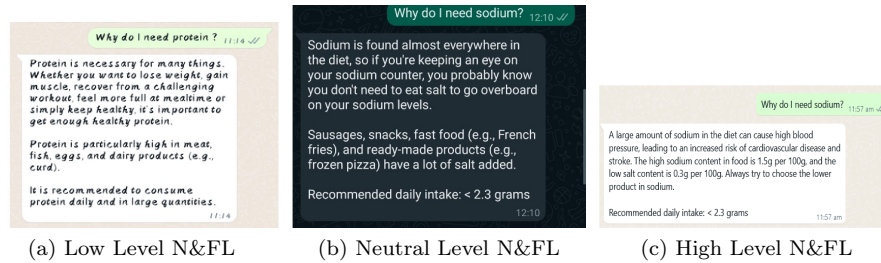


Figure 6: Chatbot UI screens of feature "*Inform extra food information*".

4 Research methodology

In the following sections, we present the research methodology of the experiment we conducted to answer our research questions. In particular, we present how we planned to recruit participants and the experiment design. We also provide details about the materials we used and the variables we planned to measure. Finally, we describe the experiment’s procedure and how we prepared our data for analysis.

4.1 Participants

Volunteers were recruited during May and June 2022 through convenience and snowball sampling. We also advertised the study on social media (Facebook, LinkedIn, Reddit) in groups about nutrition and healthy eating. We provided a 50-euro gift card to one lottery winner as compensation. Participants were eligible if they were above 18 years old, were users of the WhatsApp messaging app, and spoke and wrote in English. Participants completed an online pre-registration form with all instructions about the experiment, an informed consent form and a questionnaire confirming their eligibility.

4.2 Experiment Design

The experiment consisted of four mandatory parts and one optional, as seen in Figure 7.

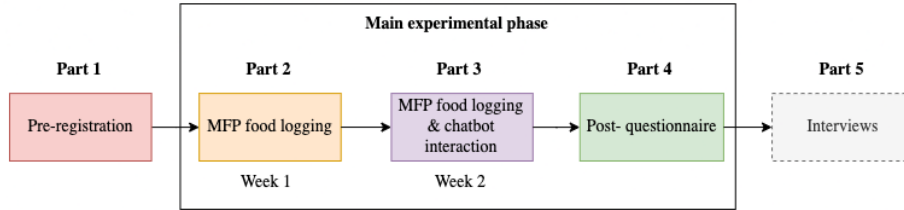


Figure 7: The designed parts of the experiment.

For Part 1, we set an online pre-registration form using Qualtrics software⁵⁸. Its duration was estimated to be approximately 10 minutes. The form consisted of demographic and N&FL questions.

The demographic questions were about their first name, age, gender, email, and WhatsApp phone number, which is essential to communicating with the chatbot.

In addition, there were two questions about their English proficiency and educational level. According to Egede *et al.*’s study, education level and English as a second language has been proven to influence user engagement [4]. Hence, we wanted to consider any confounding variables as this demographic information in our experiment.

For convenience, we used the English proficiency levels that LinkedIn provides, as we believe that most of the participants were familiar with this. To measure the education level, we used the six levels from the International Standard Classification of Education [59]. Since we did not want to gather other data excessively, no further information was requested.

In regards to the N&FL questions, as we discussed in Section 2.3.1, there are many tools to measure N&FL and its use depends on the context. By comparison of the tools on Yuen *et al.*'s review [42], we agreed to use the questions from the **NLS tool** [44]. It was originally developed in 2007 in the US to assess NL in adults. Unlike others, it has free access to the questionnaire, and its length is relatively short. The questions were 28, consisting of blanks with words to choose from. In some cases, we adjusted the questions to the metric system. Below, we provide an example of them with the correct answers in bold. The rest are in Appendix A.

- For a healthy diet, we are advised to eat five _____ of fruits and vegetables.
 - a. cups
 - b. fibers
 - c. grams
 - d. **servings**
- A 180 calorie _____ with 10 grams of fat has 50% of its calories from fat.
 - a. vitamin
 - b. fiber
 - c. **serving**
 - d. exercise

As we discussed in Section 2.3.1, Nutrition Literacy and Food Literacy are two terms bound to each other. Hence, we considered the NLS tool sufficient for this study, even though it assesses mainly NL.

Based on the answers given, there are three scoring categories: poor (0-7), marginal (8-14), and adequate (15-28) N&FL. Due to the difficulty in recruiting people of low N&FL, we deviated from this scoring and considered the following: low (0-20), and high (25-28) N&FL.

Following a between-subject design, and according to their initial N&FL score, we assigned each participant to one out of three groups: **Low Level** group with N&FL score 0-20, and **High Level** group with N&FL score 26-28. These groups interacted with an **adaptive** chatbot. Participants with N&FL score between 20-25 were assigned to a **Neutral Level** group, that interacted with the **non-adaptive** chatbot. We set as an independent variable the *chatbot's state* (adaptive/non-adaptive). For H_1 - H_4 , the dependent variables were *user engagement* and *user satisfaction*. For H_5 , the dependent variable was the

knowledge gained. In H_3 and H_4 , the levels of N&FL acted as a mediator on the effect the adaptive chatbot had on user engagement and satisfaction.

Once the participants completed the pre-registration and we assigned them to a group, they were requested to start with the main experimental phase.

Most similar studies last one month or longer, where the first week acts as a baseline and the others as post-intervention weeks [55, 60, 61]. However, we reduced the main experimental phase to 2 weeks due to limited time. During the first week, Part 2 of the experiment, the participants had to log their food using the MFP application. We provided instructions on how to do that on the first day of Week 1.

After seven days, participants received new instructions for Part 3 of the experiment. During Week 2, they had to log their food and interact with the chatbot as much as possible.

At the end of the second week, participants had to fill in a final questionnaire (Part 4 of the experiment), which was identical to the NLS questionnaire of Part 1. The purpose was to test for differences in the knowledge gained after this two-week intervention.

Finally, for the optional Part 5, we interviewed a few participants from each group that indicated a willingness to do it.

4.3 Experiment Materials

Below, we provide details of the materials we used for the experiment.

4.3.1 MyFitnessPal

Participants used MyFitnessPal (MFP), a smartphone app and website that tracks diet and exercise to log food. We considered it the best solution for this purpose, as it is one of the most popular calorie counters [62]. MFP has one of the largest food databases, and logging food is easy to achieve through manual input or by scanning the product’s barcode, as seen in Figure 8.

Additionally, we opted for this app because there was a Python MFP API allowing us to retrieve the food information from our participants and integrate it into our chatbot.

Another material we used was that of the chatbot we developed. Extended details about its development were provided earlier in section 3.

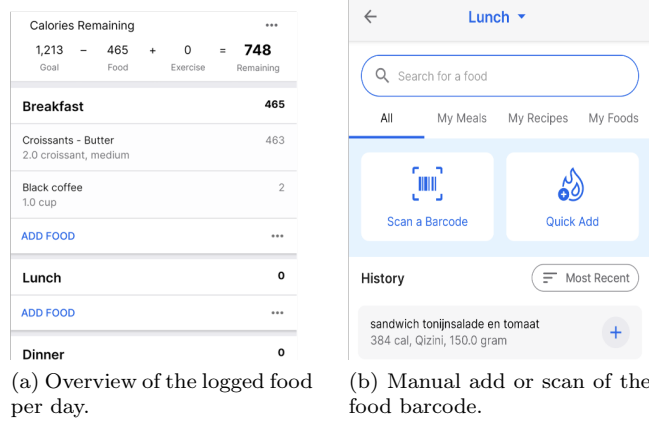


Figure 8: MFP UIs of food logging.

4.4 Experiment Measures

In regards to the research questions of this study, we aimed to measure *user engagement* and *user satisfaction*.

User engagement has been a controversial measure in chatbots so far. According to Oh *et al.*'s systematic review [63], many studies used the User Engagement Scale (UES) questionnaire [4, 60]. Other studies reported engagement using various types of measurements, such as user response rate to chatbot messages, frequency of users' weekly check-ins, and length of conversations between the chatbot and users [5, 55, 61]. In our study, we followed the second approach because UES included aspects (focused attention, perceived usability, aesthetic appeal, and reward) that were not present in our chatbot. In particular, we measured **retention rate**, **interaction rate** and **interaction length**. The results of these three form the user engagement here.

Similarly, Oh *et al.* report that *user satisfaction* measures vary across the studies. In particular, most of them combine user satisfaction with acceptability. For that, they use measures such as technology acceptance, helpfulness of the chatbot, and perceived efficiency of chatbot communications [64, 65]. On the other hand, Elsholz *et al.* used open-ended questions, and a 7-point Likert scale [5]. Since measuring user satisfaction with chatbots still needs further research, we decided to opt for a qualitative method.

We designed to conduct semi-structured interviews with some participants from each group at the end of the experiment. The questions focused on three aspects: interaction with the chatbot, knowledge gained, literacy, and text-tailoring. The interviews were designed to last approximately 30 minutes, and the complete interview protocol is found in Appendix C.

4.5 Experiment Procedure

The experiment took place between May and June 2022. Beforehand, we conducted a pilot test with one participant to ensure the feasibility of the experiment design. No major caveats were provided, and we started recruitment in mid-May 2022.

Due to a low response rate, we advertised the experiment multiple times on social media. In addition, we put up posters on university campuses and venues in Utrecht, the Netherlands, where people with low literacy might be frequent. The recruitment continued until mid-June, when a solid amount of participants gathered for each group. As far as we are concerned, no major events (i.e., Christmas) happened during this period, possibly influencing the people’s participation in the experiment.

One week after Part 1, each participant received instructions for Part 2, where they logged their food intake using MFP for one week. Some of them did it after every meal or at the end of the day. In some cases, they skipped food logging for a few days, which was expected but did not influence the experiment greatly. After seven days, we sent the instructions for Part 3. Participants logged their food as in Week 1 and interacted with the chatbot whenever they wanted. At the end of two weeks, they received the final questionnaire. In case they showed willingness, we arranged an interview, online or physically, depending on their availability.

In general, the whole procedure ran without problems. Participants sometimes would delay moving on to the next phase, and then friendly reminder emails were sent.

A technical problem occurred during the whole experiment period, lasting one day. This incident led to a small number of participants being unable to connect and interact with the chatbot. Because of it, they extended their participation one additional day, which we took into account during the data analysis.

4.6 Data Preparation

We developed a Python application to retrieve the data from MFP and the chat history of each participant with the chatbot.

The MFP data were not necessary to be analyzed to answer our research questions. However, we conducted a sanity check to ensure the credibility of the participants’ behaviour. Participants who did not log their food on MFP were excluded. Similarly, we checked the chat history to ensure that participants did not abuse it with swear words, racist comments, and others. In the end, no one was excluded from the participants that interacted with the chatbot, or data entries were removed. We also prepared the chat history data by removing all messages sent from the chatbot.

Regarding the qualitative data, we transcribed the interviews using Otter.io [66] and cleaned them from irrelevant information. The interviews’ transcriptions are in Appendix D. We used the Nvivo software [67] to analyze the data.

5 Results

Below we present the results from the data analysis. We provide descriptive statistics regarding the participants and other measures. We also illustrate the results from the tests we conducted to answer the research questions. Finally, we show results from the interviews about user satisfaction and knowledge gained.

5.1 Participants

In total, 69 people pre-registered for the experiment. Of these, 24 scored below 20 on the NLS questionnaire and originated from America, Africa and Asia ³. In contrast, 30 scored above 25 and came from Europe and America. Twenty-seven continued to Part 2 (MFP food logging), and at the end, 22 completed the experiment. Table 3 shows the final experiment distribution which contains **22 participants** across three groups based on their N&FL level, age and gender. Their age ranged from 22 to 35 years ($M = 27$ years, $SD = 4$).

N&FL Level	Sample size	Age	Gender
Low	1	$M = 24$	1 male
Neutral	7	$M = 26, SD = 3$	4 males/ 3 females
High	14	$M = 27, SD = 4$	7 males/ 7 females
Total	22	$M = 27, SD = 4$	12 males/ 10 females

Table 3: Participants’ distribution per N&FL level, age and gender.

As seen in Table 4 and Table 5, most of them ($n = 16$) were of master’s or equivalent education level, and spoke English in full professional proficiency ($n = 11$). For clarity, we have omitted categories with null data from the tables.

N&FL Level	Post secondary and tertiary education	Master’s or equivalent
Low	1	0
Neutral	0	7
High	5	9
Total	6	16

Table 4: Participants’ distribution per N&FL and education level.

³We inferred their nationality from the country code of the phone number they provided.

N&FL Level	Limited working proficiency	Professional working proficiency	Full professional proficiency	Native/Bilingual proficiency
Low	1	0	0	0
Neutral	1	3	3	0
High	0	3	8	3
Total	2	6	11	3

Table 5: Participants’ distribution per N&FL and English proficiency level.

Apart from the above descriptive statistics, we tested for differences before and after the intervention by comparing the N&FL score of each participant before and after the experiment.

We checked the normality assumption, which was violated. Hence, we conducted a Wilcoxon signed-rank test, the non-parametric test, alternative to the dependent sample t-test [68]. The result indicated that the N&FL score before ($Mdn = 25.5$) was not significantly different than the N&FL score after the intervention ($Mdn = 26$), $t = 63.5, p = .532$. Hence, there was no difference between the two N&FL scores across all participants.

Additionally, we were interested in testing if education level and English as a second language influence the N&FL for our sample (see subsection 2.3). We used Linear Mixed Models (LMM), as they allow modeling fixed and random effects among non-independent variables [69]. We applied an ordinal linear mixed-model and included each variable as a fixed factor. Beforehand, the ”age” variable was centered. The final model is shown below in Equation 1 where NL Difference is the difference between the N&FL score before and after the intervention.

$$NLDifference = Age + Gender + EducationLevel + LanguageLevel \quad (1)$$

The results from fitting the model are in Table 6. It is evident that none of the fixed factors had a significant effect on the model, meaning that none of the variables we tested influenced the change of the N&FL score.

Fixed effects	Coef.	SD	Z	$P > z $
gender:male	-0.45	0.57	-0.80	0.42
educationLevel:postSecondaryAndTertiaryEducation	-0.02	0.69	-0.03	0.98
languageLevel:limitedWorkingProficiency	0.32	1.05	0.30	0.76
languageLevel:nativeBilingualProficiency	-1.11	0.87	-1.27	0.20
languageLevel:professionalWorkingProficiency	0.02	0.70	0.03	0.97
age	-0.06	0.08	-0.67	0.50

Table 6: Summary results of the LMM with fixed factors.

5.2 User Engagement

In this section, we present an overview of the data we gathered during the experiment and the tests we conducted to answer two hypotheses from the first research question about user engagement:

H_1 : *User engagement will be higher in the adaptive than the non-adaptive nutrition chatbot.*

H_3 : *Users of low N&FL level will have higher engagement than users of high N&FL level when interacting with an adaptive nutrition chatbot.*

Due to the low sample size of the Low Level N&FL group ($n = 1$), for fairness and coherence in statistical analysis, it was not possible to test the H_3 hypothesis. Therefore, we neither confirm nor deny our hypothesis about such a group.

In the following sections, we provide the results and tests we conducted to answer H_1 . As we mentioned earlier, we measured retention rate, interaction rate and interaction length as user engagement.

5.2.1 Retention Rate

We measured retention rate as the proportion of the days each user checked in for seven days, Week 2 of the experiment. As it is visible in Table 7, the adaptive group had a higher retention rate than the non-adaptive, but in both cases, that was below 50% of the experiment duration. This result is also evident in Figure 9, where both groups followed a similar behaviour until the fourth day. Afterwards, only the adaptive group continued until the last day of the experiment.

Group	M	SD
Adaptive	51.4	27.4
Non-Adaptive	34.7	13.9
Total	46.1	24.9

Table 7: Mean and standard deviation of the retention rate between the adaptive and non-adaptive groups.

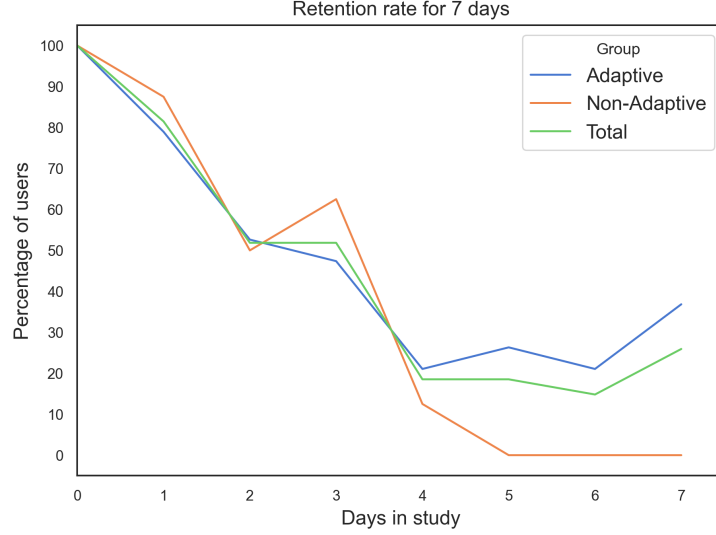


Figure 9: Line plot demonstrating the retention rate for the experiment duration between the adaptive/non-adaptive groups and cumulatively. Both groups followed a similar behaviour until the fourth day, while afterwards, participants from the non-adaptive groups stopped interacting with the chatbot.

To answer H_1 , we checked the normality assumption, which was violated, and conducted a non-parametric Mann-Whitney U test. This test was suitable because it does not assume any specific distribution, observations should be continuous or ordinal, and can be applied to unequal sample sizes as in this experiment [70, 71]. The result indicated that the retention rate was not significantly higher to the adaptive group ($Mdn = 42.9$) than to the non-adaptive group ($Mdn = 28.6$), $U = 95.0$, $p = .19$.

5.2.2 Interaction Rate

Interaction rate was the proportion of messages sent per day for the messages sent in total. In Table 9, we present the means and standard deviations and in Figure 10, we present the interaction rate for every day of the experiment. Both groups sent most of the messages on the first day. Between the second and fourth day, the non-adaptive group sent more messages, and after the fifth day, they did not continue at all, as we showed in Figure 9 as well. In contrast, the adaptive group continued sending messages on a low percentage.

Group	M	SD
Adaptive	4.94	3.46
Non-Adaptive	3.7	3.24
Total	4.55	3.37

Table 8: Mean and standard deviation of the interaction rate between the adaptive and non-adaptive groups.

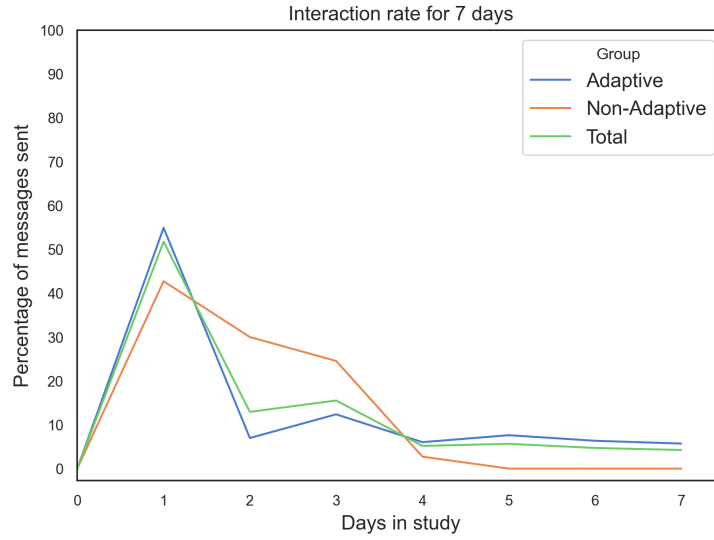


Figure 10: Line plot demonstrating the interaction rate for the experiment duration between the adaptive/non-adaptive groups and cumulatively. Both groups sent most of the messages on the first day. After the second day, the adaptive group sent much less messages than the non-adaptive group.

Again, to answer H_1 , we checked the normality assumption. Since the data were not normally distributed, we conducted a Mann-Whitney U test. The result indicated that the interaction rate was not significantly higher to the adaptive group ($Mdn = 3.5$) than to the non-adaptive group ($Mdn = 3.1$), $U = 93.0$, $p = .219$.

5.2.3 Interaction Length

We measured the total interaction length per group in minutes. As seen in Table 9, the means for both groups do not deviate from each other greatly. In both cases, a participant spent, on average, 30 minutes. However, the standard deviation indicates a wide spread of the data.

Group	M	SD
Adaptive	32.02	32.85
Non-Adaptive	27.65	30.08
Total	30.63	31.34

Table 9: Mean and standard deviation of the interaction length between the adaptive and non-adaptive groups.

In Figure 11, it is seen that both groups spent approximately the same amount of time and followed similar behaviour. Participants spent most of the time on the first day, which decreased to fewer minutes as the days passed. On average, they spent less than 20 minutes of interaction every day.

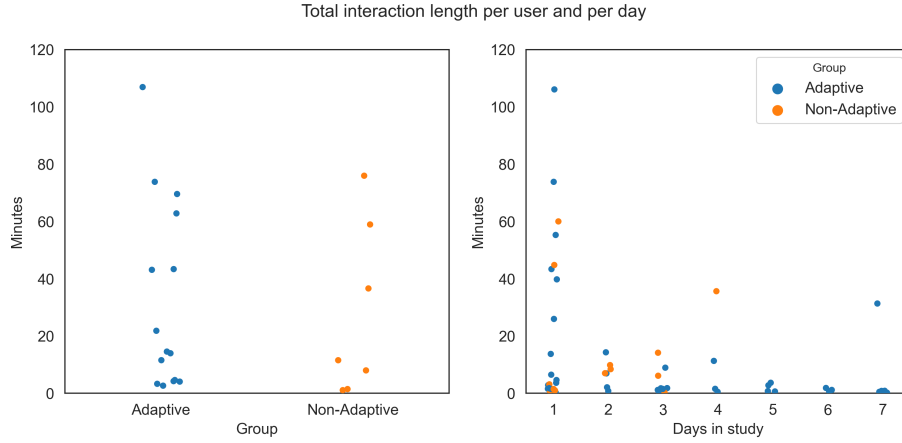


Figure 11: Plots demonstrate the interaction length between the adaptive/non-adaptive groups and per day. On the left plot, in total, both groups followed similar behaviour. On the right plot, both groups spent more time on the first day, which drastically decreased in the following days.

As previously, the normality assumption was violated, and we conducted a Mann-Whitney U test. The result indicated that the interaction length was not significantly higher to the adaptive group ($Mdn = 14.3$) than to the non-adaptive group ($Mdn = 11.3$), $U = 85.5$, $p = .355$.

In all three measures (retention rate, interaction rate and interaction length), the p-value was not significantly higher for the adaptive group than for the non-adaptive. Hence, we reject the H_1 , that user engagement is higher in the adaptive than the non-adaptive nutrition chatbot.

5.3 Hourly Message Distribution

Apart from the measures above, we were interested in finding the hourly message distribution among all participants. As seen in Figure 12, most of the traffic occurred on the first day of the interaction with the chatbot. In addition, messages were increased daily around 4 pm (UTC) when most participants received a push notification. However, the heatmap had a lot of void data (grey cells), which reflects the fact that most of the participants decreased their interaction during the night hours and after the fourth day, as shown in the previous sections.

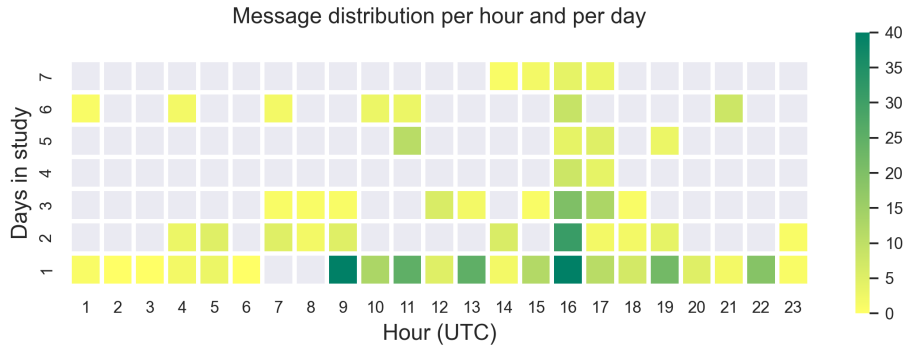


Figure 12: Heatmap showing message distribution per hour and day of the experiment. An increased number of messages were received on the first day and around 4 pm (UTC) when the push notification was sent.

5.4 Textual Content

Another insight our research questions did not test but was interesting to analyze was the text content the users sent.

For that, we filtered the messages by keywords and looked into seven categories: the five macronutrients, "calories," and "overview". We measured the percentage of messages that included this specific information for each category. The results, as seen in Figure 13, showed that the adaptive group was primarily interested in the "protein" information since, in approximately 50% of the messages sent, they mentioned this keyword.

In contrast, the non-adaptive group showed a more balanced interest in the nutrients. However, most messages included the keyword "calories", meaning they were mostly interested in this information.

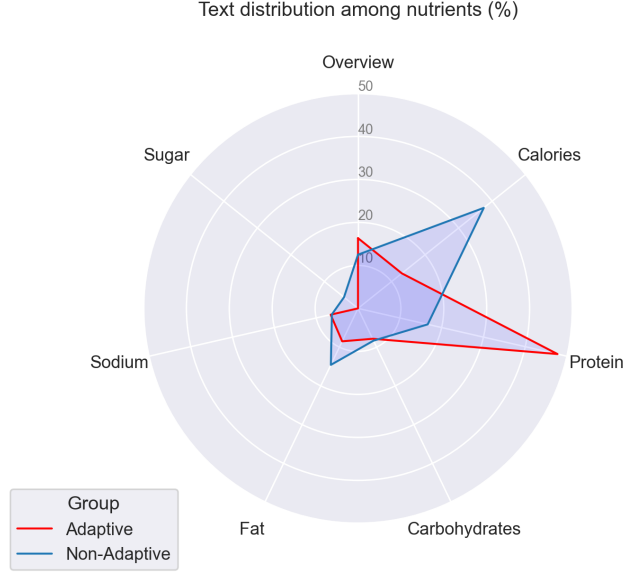


Figure 13: Spider chart showing the percentage of information each group was most interested in. The adaptive group showed increased interest in the "protein" information. The non-adaptive group showed a higher interest in the "calories" information.

5.5 User Satisfaction

In this section, we present the results from the qualitative analysis to answer the following hypotheses:

H₂: User satisfaction will be higher in the adaptive than the non-adaptive nutrition chatbot.

H₄: Users of low N&FL level will have higher satisfaction than users of high N&FL level when interacting with an adaptive nutrition chatbot.

As before, due to the low sample size of the Low Level N&FL group ($n = 1$), we did not test the H_4 hypothesis. Therefore, we neither confirm nor deny our hypothesis about such a group.

To answer H_2 , we conducted seven semi-structured interviews. Table 10 demonstrates the demographics of each interviewee.

Sequence number	Age	Gender	Education Level	English Language Proficiency	Group in Nutrition
1	28	Male	Post-secondary and tertiary education	Full professional proficiency	Adaptive
2	24	Male	Master's or equivalent	Limited working proficiency	Non-Adaptive
3	24	Male	Post-secondary and tertiary education	Limited working proficiency	Adaptive
4	25	Female	Master's or equivalent	Professional working proficiency	Non-Adaptive
5	23	Female	Post-secondary and tertiary education	Native/Bilingual proficiency	Adaptive
6	22	Male	Master's or equivalent education	Professional working proficiency	Non-Adaptive
7	26	Male	Post-secondary and tertiary education	Native/Bilingual proficiency	Adaptive

Table 10: Demographic data from participants sorted by sequence of interview.

Four interviewees were from the adaptive group and three from the non-adaptive. A general note derived from the interviews was that in most cases, the adaptive group claimed to be more enthusiastic and interested in nutrition. On the other hand, the non-adaptive group expressed indifference about diet and being healthy. Below we show an indicative quote from each group:

- *"I'm not really into it. So I don't know anything about it."*, Participant #2, NA⁴.
- *"I am more interested in wanting to monitor my health and diet, because I think there are things I can do to improve."*, Participant #7, A.

To analyze the data, we followed the Grounded theory [72], an emergent coding approach, which is systematically used for text-based data.

The resulting main themes with related sub-themes are in Table 11: (1) *Satisfaction*, with the sub-themes Enjoyment, Knowledge gained, Literacy liked, Useful and User-friendly, (2) *Dissatisfaction* with the sub-themes Dislike, Insecure, Misleading and Useless, (3) *Insights* and (4) *Improvements* with the

⁴A: Adaptive, NA: Non-Adaptive.

sub-themes Literacy improvement, Integration to MFP, Push notification, Food recommendations.

Main theme and sub-themes	Interviewee's quotes
Satisfaction	
Enjoyment	<p>"It felt more natural to talk with him that we think." (Participant #1, A)</p> <p>"Yeah, it was it was enjoyable." (Participant #2, NA)</p> <p>"I liked sort of the idea of interacting with a chatbot." (Participant #6, NA)</p>
Knowledge gained	<p>"I gained a bit knowledge." (Participant #4, NA)</p> <p>"A bit, I guess, because now I know that proteins and yoghurts are a bit similar" (Participant #4, NA)</p>
Literacy liked	<p>"I think it was understandable." (Participant #1, A)</p> <p>"Yeah, I can understand that. No problem." (Participant #3, A)</p> <p>"I didn't mind the numbers." (Participant #5, A)</p> <p>"I found it to be understandable." (Participant #7, A)</p>
Useful	<p>"It's way easier to just have somebody and ask. It takes two seconds." (Participant #2, NA)</p> <p>"It did have like useful information." (Participant #5, A)</p> <p>"It was helpful." (Participant #7, A)</p>
User-friendly	<p>"It was more user friendly than I expected." (Participant #1, A)</p> <p>"I also noticed kind of casual way of talking and smiley's and I intimated also a bit." (Participant #4, NA)</p> <p>"Especially because it was over WhatsApp, which I'm really used to." (Participant #6, NA)</p>
Dissatisfaction	
Dislike	<p>"I know, it's not like an actual person on the other side. I know, it's like a bot." (Participant #5, A)</p>
Insecure	<p>"You are not sure if you have done something wrong, or if it is the chatbot stupid" (Participant #5, A)</p> <p>"Yeah, I don't want to send some random person accidentally" (Participant #6, NA)</p>

Misleading	"Hamburger isn't a fruit so I was quite confused by it." (Participant #4, NA) "I asked about potassium, but then it was like, Oh, good job. You have enough calories." (Participant #6, NA)
Useless	"That makes the chatbot redundant for to know what your calories of your food are for." (Participant #1, A) "I don't think I gained any more information from the chatbot." (Participant #5, A)
Insights	"I thought I was eating too much carbs. But then I was wrong." (Participant #2, NA) "Definitely learned how my kind of day to day diet op- erates." (Participant #7, A)
Improvements	
Literacy	"If anything, I would add more numbers." (Participant #1, A) "I think more information is better, especially when it comes to nutrition." (Participant #5, A) "Yeah, I mean, the more granular the more I can sort of see, the better." (Participant #7, A)
Integration to MFP	"The improvement would be very limited." (Participant #1) "I don't know if I would use it if I'm being honest." (Participant #5, A)
Push notification	"The next feature would be if the chatbot sends you a reminder that, hey, you're doing low on sodium." (Participant #1, A) "I would like to have my fitness overview in the main screen." (Participant #3, A)
Food recommendations	"That would be nice, I think, specific meal recommendations." (Participant #1, A) "I think it's quite helpful if they suggest something you should eat." (Participant #4, NA)

Table 11: Themes, sub-themes, and some quotes by interviewees.

To answer H_2 , we compared the percentage of references between satisfaction and dissatisfaction. As seen in Figure 14, participants from the non-adaptive group enjoyed interacting with the chatbot more than the adaptive group and did not express any dislike at all. In addition, they discussed multiple times that they were ignorant about nutrients in certain foods, and with this interaction,

they learned some new information. They also agreed that it was user-friendly to an extent but sometimes felt insecure at the beginning, mainly due to the integration on WhatsApp.

In contrast, the adaptive group expressed higher dislike, primarily due to the chatbot’s lower intelligence to understand the user and provide correct answers. Additionally, this led to more misleading responses, and users considered it useless. Simultaneously, they considered having a chatbot providing nutrition advice very useful. The misleading responses made them feel even more insecure than the non-adaptive group.

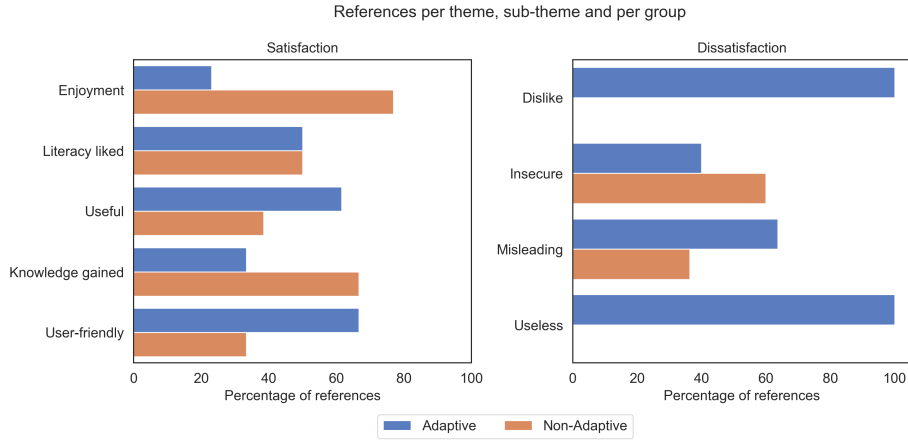


Figure 14: Bar chart showing the percentage of references per category and group. In general, the adaptive group expressed higher dissatisfaction, while the non-adaptive group enjoyed interacting with the chatbot more.

Regarding text adaptations based on N&FL, both groups were equally satisfied with what they were provided. In addition, as seen in the sub-theme *Literacy of Improvements* in Table 11, participants from the adaptive group expressed their need to be provided with even more numbers and statistics than they already had in the messages.

Based on our presented results, we can reject H_2 as well, as people from the adaptive group tended to be less satisfied and the non-adaptive group seemed to have enjoyed the chatbot more.

5.6 Knowledge Gained

During the interview, we asked participants if they gained any knowledge about nutrition to answer:

H₅: The Knowledge of a user with a low level of N&FL will increase when interacting with an adaptive than a non-adaptive nutrition chatbot.

In most cases, they replied that they did not gain any new knowledge. Rather, they received better **insights** into their nutrition and how it works. For example, an interviewee answered:

"I definitely learned how my kind of day to day diet operates. Because I think when you were kind of taught constantly talking to someone about what you eat, even if it's like AR/AI powered, I think it forces you to be more conscientious about your food decisions.", Participant #7, A.

Both groups had almost similar answers; hence we can reject this hypothesis as well.

5.7 Improvements

Finally, we gathered some useful insights on how the chatbot could be improved. Most of them focused on the push notification. Some suggestions were:

- sending a notification with an overview of the day (Participant #4, NA),
- or having an overview of the calories on the main screen (Participant #3, NA),
- sending a notification when the user is low on a particular nutrient (Participant #1, A),
- sending a notification with healthy tips throughout the day (Participant #7, A),

Regarding integrating the chatbot to the MFP application, some approved the concept, and others did not. However, everyone would welcome the idea of the chatbot being able to provide them with food recommendations based on their diet.

6 Discussion & Future Work

This section discusses our findings in combination with the theory from the literature review. In addition, we give directions for future work, and we present the study’s limitations.

6.1 Review of Results

Nutrition and Food Literacy are two terms that have been given little to no interest within the domain of nutrition chatbots. To our knowledge, this is the first study to deepen on these, as other similar studies take it into account but focus elsewhere [4, 73]. In our case, we researched if an adaptation of N&FL influences user engagement and satisfaction. Furthermore, we looked into the knowledge gained from interacting with the chatbot.

Based on the results shown in section 5, we cannot argue that text-adaptation on N&FL influenced user-engagement. Most participants followed the same interaction behaviour, despite the N&FL group they belonged to. In particular, they showed high interest in the first days, which decreased in the following days of the experiment. Such behaviour is common among intervention studies [55, 56, 60], and does not provide us with new insights. Similarly, the interaction duration lasted only a few minutes per day (less than 20), which is considered normal as the average daily time spent on WhatsApp is estimated to be 38 minutes [57]. Consequently, we argue that the experiment duration was insufficient compared to other studies that last more than two weeks [55, 60, 61]. More experiment time would be needed to verify if user engagement, as we measured it, remains the same low or diversifies.

However, it is worth noting that interaction for both groups increased when the push notification was sent. Such a result agrees with Freyne *et al.*’s findings that push notifications are an appropriate way to increase engagement [56]. With the noticeable increase in user engagement due to this reminder, we propose that future work focuses on this attribute of a nutrition chatbot. In particular, future studies could research text adaptation in the notifications’ content. As we gathered from the interview insights, adaptations could include an overview of the day or when they are low on a particular nutrient.

Another remarkable finding was the differences in interest from the textual content analysis. The adaptive group showed genuine interest in the ”protein” information, while the non-adaptive group was more interested in the ”calories” information. An explanation for this is that, as the interviews showed, people of high N&FL, the adaptive group, already possess advanced nutrition knowledge or have increased interest in it. Hence, they know that protein is an essential macronutrient in daily diet. On the contrary, the non-adaptive group were less interested in nutrition. Because of it, we speculate that this is why they asked more frequently about their ”calories” intake only.

In the same manner, higher interest in nutrition from the adaptive group could be why they showed higher dissatisfaction with the chatbot. They were interested in ”advanced” questions that the chatbot could not answer. Hence,

it responded wrongly, causing them dislike, mislead and insecurity. These sentiments disagree with our initial assumption that text adaptation would please the user more than no adaptation. Another possible reason could be that the text adaptations were not sufficient for that group, meaning they had higher expectations from the chatbot. For that, we would need to find additional text adjustments to satisfy them, such as more numbers or graphic display formats such as progress charts [33, 73].

In contrast, people from the non-adaptive group were less interested in nutrition. Because of it, they expressed higher satisfaction and enjoyment in interacting with the chatbot. However, these are only assumptions. The correlation between interest in nutrition and user needs from a nutrition chatbot is out of the scope of this research. We suggest that more research is conducted to verify our assumptions and whether different interest in nutrition leads to different user needs and expectations from a nutrition chatbot.

With regards to satisfaction from the text provided, there were no major differences between groups. Such could be explained by the fact that our sample was homogeneous, consisting mainly of people in their 20s with a higher education level. Hence, their literacy, independent of nutrition, is already high, and they can understand any text, from simple to advanced vocabulary. On the contrary, the sample was more diverse in Egede *et al.*'s study, including participants from the U.K. and Nigeria [4].

For the same reason of a homogeneous sample, we cannot confirm nor deny Egede *et al.*'s findings that education level and English as a second language influence user engagement in chatbots. However, in the initial pre-registration form, we noticed a pattern that people from America, Africa and Asia scored lower in the NLS questionnaire, which hints at cultural differences in nutrition and literacy as we used the metric system in our study. As Velardo argues Nutrition Literacy is influenced by culture and society, and it is important to consider the role of deeply rooted socio-cultural norms regarding health and eating [37]. For that, we propose the study to be repeated with more specific target participants, for instance, people exclusively from two different countries and use metrics they are familiar with.

Lastly, this study was not focused on educating people about nutrition. Hence, it justifies the fact that all participants claimed to have no knowledge gained on nutrition. Our quantitative results also confirm this since there was no difference in the N&FL score before and after the intervention. As previously mentioned, the homogeneity of the sample could be one reason. People with different backgrounds and lower literacy could learn something new if the study was repeated. In the context of promoting N&FL at schools, the experiment could be repeated by recruiting children. Due to their young age, their N&FL is considered low, and it would be interesting to research further the impact of a nutrition chatbot targeted at young children in gaining knowledge.

All in all, user engagement and satisfaction proved to be similar, regardless of the adaptation on the N&FL. However, there are interesting pointers for further research, such as content adaptation in the push notifications. In addition, different interest in nutrition can impact user engagement, which would be worth

looking further into. Lastly, we suggest that the study is repeated for a more extended period or with a more diverse sample, as culture and age were very similar here.

6.2 Limitations

This study had some limitations, which we discuss in detail below.

A major restriction was the N&FL measuring tool, NLS. As we explained in subsection 4.2, there are multiple tools developed [42], and each is valid if used in the proper context. We opted for NLS due to its short length (28 questions), free access, and applicability to the general population. However, the questions seemed relatively easy to answer, even with very low literacy. Hence, we believe this to have negatively influenced the people’s distinction into different N&FL levels, as most of them were considered highly literate. A solution would be the development of a better N&FL assessment tool, which can also be integrated into the chatbot. As we discussed in our literature review on the evolution of chatbots, we could use neural modelling and, in general, machine learning to develop a more intelligent chatbot. Its innovation would be the ability to assess the N&FL of the user and adjust its text continuously while being used.

On a technical level, our system had some clear constraints. Although our initial intention was to develop an advanced AI-based chatbot, we ultimately developed a basic rule-based chatbot with limited functionalities and intelligence due to the short research time and technical knowledge. Consequently, it was less robust in answering all questions the users asked. More development time could help train the model to recognize more entities and overpass such linguistic constraints. Another advance would be providing information about additional nutrients, as interviewees expressed interest. In addition, due to our system’s setup through Twilio’s sandbox, push notifications were sent only when someone connected to the chatbot and remained active for at least 24 hours. Due to this, we believe that users did not always receive these notifications, leading to lower user engagement. A different setup would solve this problem.

As far as ANLG is concerned, we discussed its importance in personalization and behaviour change at the beginning. In the experiment, we attempted to integrate techniques such as redundancy, inclusion, and first plural person in the text. Although, we believe not to have used its strategies to the intended extent. In addition, as the satisfaction results indicated, users had higher expectations, meaning that the chatbot might not have been adaptive enough. Both limitations require extensive knowledge in human psychology and linguistics and would require a collaboration with external domains to bring a satisfactory result in text adaptation.

Another domain we lacked knowledge in was that of nutrition. This absence limited us in the nutrition recommendations we could provide users through the chatbot implementation. As such a study is interdisciplinary, it requires deep knowledge of nutrition. We suggest that a collaboration with the corresponding department would benefit greatly from it and improve the chatbot’s capabilities.

Finally, the findings are limited in generalizability to persons of older age

and lower education since our sample included participants of young age and medium to higher education. The principal responsible for this limitation is the low recruitment of participants of low N&FL. Although we approached a vast population by advertising the study online, the turnout was meagre. Additionally, we believe that reaching people of low N&FL did not emerge as expected. An increase in funding or targeted advertisement to smaller communities could help with such limitations.

7 Conclusion

With this section, we conclude our research. Our original goal was to examine the N&FL of the user in combination with an adaptive nutrition chatbot. In particular, our research questions hypothesised that N&FL of the user influenced user engagement and satisfaction.

To answer them, we conducted an experiment that initially assessed the N&FL of the user. Afterwards, the users interacted with the nutrition chatbot that adapted its text. We compared their behaviour with a group of users that interacted with a non-adaptive chatbot and measured user engagement, satisfaction and knowledge gained.

The results showed similar behaviour between the groups. Additionally, the interaction was higher when users received a push notification which acted as a reminder. On the other side, our qualitative research indicated some difference in satisfaction, which was opposed to our initial assumptions. Through the experiment, we also found that interest in nutrition could influence user engagement and user satisfaction a lot.

As discussed in the literature review, chatbots are becoming increasingly popular within the mHealth domain. However, they still stand many challenges, including understanding human behaviour as well as technical, design and linguistics challenges. Motivated by the research gaps in the human behaviour challenges, we looked into the N&FL of the user, which has been overshadowed so far.

With this research, we hope to have gone one step further into solving one of the many challenges chatbots face. Although N&FL proved to be not so important, we should acknowledge that other personal characteristics, such as interest in nutrition, can influence engagement and satisfaction to a higher degree. As argued in the beginning, personal characteristics, and hence personalisation, play a major role in dietary patterns and behaviour change. By increasing these measures on a chatbot, we wish that users will adhere more and more to the nutrition advice. Hence, they will be led to behaviour changes regarding their dietary patterns, and as initially stated, switching to a healthier lifestyle is the key to good health and disease prevention.

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A NLS questionnaire

1. Healthy eating is really supposed to ____ our heart.

- ☐ grow
- ☐ ag
- ☐ **help**
- ☐ bypass

2. However, no single food can supply all the nutrients in the ____ we need.

- ☐ meals
- ☐ **amount**
- ☐ fiber
- ☐ portions

3. Eating a ____ of foods ensures you get all the nutrients needed for good health.

- ☐ lot
- ☐ many
- ☐ **variety**
- ☐ kilo

4. Grains, fruits and vegetables are food groups that form the basis of a(an) ____ diet.

- ☐ energy
- ☐ fat-free
- ☐ **protein**
- ☐ healthy

5. For a healthy diet, we are advised to eat five ____ of fruits and vegetables

- ☐ cups
- ☐ fibers
- ☐ grams
- ☐ **servings**

6. each ____ .

- ☐ **day**
- ☐ morning
- ☐ meal
- ☐ year

7. Foods like butter have lots of ____ fat which can increase cholesterol.

- ☐ calorie-free
- ☐ bacon
- ☐ **saturated**
- ☐ diet

8. Cholesterol can be affected by foods high in trans fatty ____.

- ☐ oils
- ☐ **acids**
- ☐ fiber
- ☐ diet

9. Experts often recommend to ____ these foods,

- ☐ **avoid**
- ☐ use
- ☐ drink
- ☐ eat

10. ...because they are ____.

- ☐ delicious
- ☐ healthy
- ☐ **fattening**
- ☐ calories

11. Fiber is the part of plant-based foods that your ____ does not digest and absorb.

- ☐ **body**
- ☐ portion
- ☐ weight
- ☐ eating

12. Whole grains provide more ____ than processed grains.

- ☐ weight
- ☐ good
- ☐ **fiber**
- ☐ nutritious

13. A good diet should contain approximately 25 to 30 ____ of fiber a day.

- ☐ **grams**
- ☐ cups
- ☐ portions
- ☐ calories

14. Calcium is ____ for bone health.

- **essential**
- osteoporosis
- expensive
- prescription

15. As you age, your bones may get thinner as minerals are ____.

- **lost**
- weakened
- skinny
- tall

16. Even in older people, Vitamin D is ____ to keep bones healthy.

- wants
- sunny
- mineral
- **needed**

17. Foods with added sugars are sometimes called foods with empty ____.

- cups
- fat
- **calories**
- vitamins

18. To prevent ____ from bacteria,

- omelets
- groceries
- pain
- **illness**

19. keep eggs in the ____.

- pantry
- frying pan
- chicken
- **refrigerator**

20. Farmers who grow organic foods don't use ____ methods to control weeds.

- **conventional**
- expensive
- compost
- herbal

21. They control ____ by techniques such as crop rotation, rather than pesticides.

- nutrients
- **weeds**
- markets
- it

22. For this, as well as other reasons, organic food ____ than conventional food.

- **costs more**
- tastes better
- cooks faster
- has more fiber

23. A 180 calorie ____ with 10 grams of fat has 50% of its calories from fat.

- vitamin
- fiber
- **serving**
- exercise

24. A 60kg woman needs about 51 ____ of protein a day

- servings
- **grams**
- portions
- cups

25. Using fat-free ____ on a sandwich can really cut down on the grams of fat.

- sugars
- **mayonnaise**
- vitamins
- salads

26. The doctor told me that "fat-free" is not the same as ____.

- vitamin-free
- snack-free
- weight-free
- **calorie-free**

27. The doctor also told me to make the size of my ____ smaller to help control

- waistline
- **portions**
- glass
- calories

28. ...my ____.

- fattening
- vitamins
- meals
- **weight**

B Text templates

A. INFORM_OVERVIEW

	Low Level	Neutral Level	High Level
Scenario 1	<p>Well, \$user_name, calorie-wise, you are [higher lower] than your target. [Good job! 🍌]</p> <p>\$nutr_1 and \$nutr_2 are kept on a good level.</p> <p>However, your \$nutr_1 and \$nutr_2 intake needs a bit [of work of improvement]. You could consider eating [more less] \$food_example_1 and [more less] \$food_example_2.</p> <p>Is everything clear to you? Do you have any further questions you'd like to ask me?</p>	<p>Well, \$user_name, calorie-wise, you are \$nutr_1_value_percentage [higher lower] than your target. [Good job! 🍌]</p> <p>\$nutr_1 and \$nutr_2 are kept on a good level.</p> <p>However, your \$nutr_1 and \$nutr_2 intake needs a bit [of work of improvement]. You could consider eating [more less] \$food_group_1 and [more less] \$food_group_2.</p> <p>Is everything clear to you? Do you have any further questions you'd like to ask me?</p>	<p>Well, \$user_name, calorie-wise, you are \$nutr_1_value_percentage [higher lower] than your target. [Good job! 🍌]</p> <p>You had \$nutr_1_value out of \$nutr_1_value_target of \$nutr_1 and \$nutr_2_value out of \$nutr_2_value_target of \$nutr_2 which is great!</p> <p>However, your \$nutr_1 (\$nutr_1_value) and \$nutr_2 (\$nutr_2_value) intake exceeded the recommended intake (\$nutr_1_value / \$nutr_1_target and (\$nutr_2_value / \$nutr_2_target respectively). You could consider cutting down on these.</p> <p>Is everything clear to you? Do you have any further questions you'd like to ask me?</p>
Scenario 2	<p>So, the good news is that \$nutr_1 and \$nutr_2 are around the recommended intake. 🍌🍌</p> <p>However, you should consider cutting down on \$nutr_1 and \$nutr_2, as it will not help you achieve your goal. How about eating [more less] \$food_example_1 and [more less] \$food_example_2?</p> <p>Would you like to ask something more?</p>	<p>So, the good news is that \$nutr_1 and \$nutr_2 are around the recommended intake. (\$nutr_1_value / \$nutr_1_target and \$nutr_2_value/\$nutr_2_target) 🍌🍌</p> <p>However, you should consider cutting down on \$nutr_1 and \$nutr_2, as it will not help you achieve your goal. How about eating [more less] \$food_group_1 and [more less] \$food_group_2 for a healthy diet?</p> <p>Would you like to ask something more?</p>	<p>So the good news is that \$nutr_1 and \$nutr_2 are on target. You had \$nutr_1_value of \$nutr_1 and \$nutr_2_value of \$nutr_2 which are around the recommended intake (\$nutr_1_value_target and \$nutr_2_target for each) 🍌🍌.</p> <p>However, you should consider cutting down on \$nutr_1 and \$nutr_2, as you had an additional \$nutr_1_value_sup and \$nutr_2_value_sup of them, and it will not help you achieve your goal.</p> <p>Would you like to ask something more?</p>

B. INFORM_SPECIFIC_NUTRIENT_STATS

	Low Level	Neutral Level	High Level
Scenario 1	<p>Your \$nutr_1 intake [was kept on a good level. Keep up the good work 🍌/needs some improvement. Perhaps you could consider eating [more/less] \$food_example_1 and [more/less] \$food_example_2?!]</p> <p>Want to know something else?</p>	<p>Your \$nutr_1 intake was \$nutr_1_value out of \$nutr_1_value_target which is [higher below] your target. Perhaps you could consider eating [more/less] \$food_group_1 and [more/less] \$food_group_2?!] for a healthy diet?</p> <p>Want to know something else?</p>	<p>Your \$nutr_1 intake was \$nutr_1_value out of \$nutr_1_value_target. [That's good. Keep up the good work 🍌/It seems that this needs a bit of improvement to reach your goal.</p>
Scenario 2	<p>It looks good. Keep it up 😊/ Hmm, it seems that you have been eating a lot of \$nutr_1 😞. It would be better to reduce it.</p> <p>Anything else I can help with?</p>	<p>It looks good. Keep it up 😊/ Hmm, it seems that you have been eating a lot of \$nutr_1 (\$nutr_1_value / \$nutr_1_target) 😞. It would be better to reduce it.</p> <p>Anything else I can help with?</p>	<p>\$nutr_1_value/\$nutr_1_value_target It looks good. Keep it up 😊/ Hmm, it seems that you have been eating \$nutr_1_value of \$nutr_1 😞. It would be better to reduce it by \$nutr_1_value_percentage.</p> <p>Anything else I can help with?</p>

C. INFORM_FOOD_CONSUMPTION

	Low Level	Neutral Level	High Level
Scenario 1	<p>Of the foods you ate, "\$food_name" was the [highest lowest] in \$nutr_1. Why don't you substitute it with \$food_example?</p>	<p>Of the foods you ate, "\$food_name" had the [most least] \$nutr_1 (\$nutr_1_value). Why don't you substitute it with [more less] of \$nutr_1_group.</p>	<p>Of the foods you ate, "\$food_name" was the [highest lowest] in \$nutr_1 with \$nutr_1_value.</p>
Scenario 2	<p>\$food_name. I know that changing what you eat is hard but consider your [motivation]. You could try eating something with [more less] \$nutr_1 next time, such as \$food_example.</p>	<p>\$food_name with \$nutr_1_value of \$nutr_1. I know that changing what you eat is hard but consider your [motivation]. You could try shifting your balance to eating [more less] \$nutr_1_group.</p>	<p>\$food_name with \$nutr_1_value of \$nutr_1. I know that changing what you eat is hard but consider your [motivation].</p>

D. INFORM_EXTRA_FOOD_INFO

Fat

	Low Level	Neutral Level	High Level
Scenario 1	<p>A healthy amount of fat protects our cells, blood, and brain.</p> <p>It is found mainly in oil, butter, margarine, sweets, pastries, sausage, and cheese.</p> <p>You should consume fat occasionally.</p>	<p>Fats are macronutrients that, like carbohydrates, provide energy. A healthy amount of fat protects our cells, blood, and brain.</p> <p>It is found mainly in fat and oil products. The recommended daily intake is 20-35% of total energy.</p>	<p>Fats are macronutrients that, like carbohydrates, provide energy. Per gram, they provide more energy than carbohydrates and thus serve as energy stores in the body.</p> <p>Recommended intake: 20-35% of total energy.</p>
Scenario 2	<p>Fat provides energy for our daily activities.</p> <p>It is found mainly in oil, butter, margarine, sweets, pastries, sausage, and cheese.</p> <p>You should consume fat occasionally.</p>	<p>Fats are macros that provide energy for our daily activities.</p> <p>It is found mainly in oil, butter, margarine, sweets, pastries, sausage, and cheese.</p> <p>The recommended daily intake is 20-35% of total energy.</p>	<p>Fats are macros that provide energy. When energy intake is higher than consumption, fat accumulates and promotes the development of obesity.</p> <p>The recommended intake is 20-35% of total energy.</p>
Scenario 3	<p>Fat helps you feel full and maintain a more steady blood sugar level.</p> <p>It is found mainly in oil, butter, margarine, sweets, pastries, sausage, and cheese.</p> <p>You should consume fat occasionally.</p>	<p>Fat helps you feel full and maintain a more steady blood sugar level.</p> <p>Food like butter have lots of saturated fat which can increase cholesterol.</p> <p>The recommended daily intake is 20-35% of total energy.</p>	<p>Dietary fats can be divided into three main groups:</p> <ul style="list-style-type: none"> - Monounsaturated fats - Polyunsaturated fats - Saturated fats <p>Primary sources:</p> <ul style="list-style-type: none"> Monounsaturated fats - Vegetable oils. Polyunsaturated fats - seeds, nuts, fatty fish Saturated fats - Butter, dairy products, animal products.

Carbohydrates

	Low Level	Neutral Level	High Level
Scenario 1	Our bodies need carbs, particularly glucose, since it's the preferred	Our bodies need carbs, particularly glucose, since it's the preferred	Carbohydrates are macronutrients that are most abundant in our diet. They

	fuel for tissues and organs to perform essential functions. Bread, rice, pasta, potatoes, and cereals contain a lot of carbohydrates. You should consume carbohydrates daily but not in big portions.	fuel for tissues and organs to perform essential functions. Bread, rice, pasta, potatoes, and cereals contain a lot of carbohydrates. The recommended daily intake is 45-65% of total energy.	are the main source of energy for our daily activities. The recommended daily intake is 45-65% of total energy.
Scenario 2	Carbohydrates (or “carbs”) are the primary energy source for our daily activities. Bread, rice, pasta, potatoes, and cereals contain a lot of carbohydrates. You should consume carbohydrates daily but not in big portions.	Carbohydrates (or “carbs”) are the primary energy source for our daily activities. Bread, rice, pasta, potatoes, and cereals contain a lot of carbohydrates. The recommended daily intake is 45-65% of total energy.	Carbohydrates or carbs divide into simple and complex. Simple carbohydrates (“sugars”) are digested and absorbed into the bloodstream quickly, while complex carbohydrates (starch and fiber) are digested and absorbed slowly. The recommended daily intake is 45-65% of total energy.

Sugar

	Low Level	Neutral Level	High Level
Scenario 1	Eating too much sugar is related to a poor diet and excess calorie consumption contributing to weight gain. Sugar is very much in sweets, pastries, ready-made products, and sweet drinks such as soft drinks. You should consume sugar in small amounts or monthly.	Eating too much added sugar is related to poor dietary quality and possibly excess calorie consumption, contributing to weight gain. Sugar is very much in sweets, pastries, ready-made products, and sweet drinks such as soft drinks. Recommended consumption: <5% of total energy	Sugars are simple carbohydrates quickly digested and rapidly absorbed into the bloodstream. High sugar intake is associated with obesity and tooth decay. Recommended consumption: <5% of total energy.

Scenario 2	<p>Sugar is a carbohydrate and is very much in sweets, pastries, ready-made products, and sweet drinks such as soft drinks.</p> <p>You should consume sugar in small amounts or monthly.</p>	<p>Foods with added sugars are sometimes called foods with empty calories.</p> <p>Sugar is a carbohydrate and is very much in sweets, pastries, ready-made products, and sweet drinks such as soft drinks.</p> <p>The recommended consumption: <5% of total energy.</p>	<p>"Free sugars" such as monosaccharides (glucose and fructose) and disaccharides (sucrose and table sugar) are often added to food. They should be consumed in small amounts, as they have adverse health effects.</p> <p>The recommended consumption: <5% of total energy.</p>
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Protein

	Low Level	Neutral Level	High Level
Scenario 1	<p>Protein is a crucial part of every cell in our bodies.</p> <p>It is particularly high in meat, fish, eggs, and dairy products (e.g., curd).</p> <p>It is recommended to consume protein daily and in big quantities.</p>	<p>Protein is a crucial component of every cell in our bodies.</p> <p>It is particularly high in meat, fish, eggs, and dairy products (e.g., curd).</p> <p>Recommended intake: 10-35% of total daily energy.</p>	<p>Protein is essential to maintaining a healthy and well-functioning body. The main role of protein in our body is to serve as "building material" as it helps form and repair certain important substances and processes.</p> <p>Recommended intake: 10-35% of total daily energy.</p>
Scenario 2	<p>Protein is necessary for many things. Whether you want to lose weight, gain muscle, recover from a challenging workout, feel more full at mealtime or simply keep healthy, it's important to get enough healthy protein.</p> <p>Protein is particularly high in meat, fish, eggs, and dairy products (e.g., curd).</p> <p>It is recommended to consume protein daily and in large quantities.</p>	<p>Protein is necessary for many things. It's essential to get adequate amounts of healthy protein, whether you want to lose weight, gain muscle, recover from a tough workout, feel more satiated at mealtime, or simply maintain good health.</p> <p>Recommended intake: 10-35% of total daily energy.</p>	<p>Protein is essential for many metabolic processes in the form of enzymes.</p> <p>Recommended intake: 10-35% of total daily energy.</p>

Sodium

	Low Level	Neutral Level	High Level
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Scenario 1	<p>Sodium affects blood pressure, leading to heart problems in the long term.</p> <p>Sausages, snacks, fast food (e.g., French fries), and ready-made products (e.g., frozen pizza) have a lot of salt added.</p> <p>It is recommended to consume it in small quantities daily.</p>	<p>The sodium content of salt is needed to regulate the amount of water in our bodies.</p> <p>However, sodium affects blood pressure, leading to cardiovascular problems in the long term.</p> <p>Recommended daily intake: < 3750 grams</p>	<p>The sodium content of salt is needed to regulate the amount of water in our body, transmit signals from the nerves, and move the muscles. However, salt intake is usually higher than recommended.</p> <p>Recommended daily intake: < 3750 grams</p>
Scenario 2	<p>Sodium is found almost everywhere in the diet, so if you're keeping an eye on your sodium counter, you probably know you don't need to eat salt to go extreme on your sodium levels.</p> <p>Sausages, snacks, fast food (e.g., French fries), and ready-made products (e.g., frozen pizza) have a lot of salt added.</p> <p>It is recommended to consume it in small quantities daily.</p>	<p>Sodium is found almost everywhere in the diet, so if you're keeping an eye on your sodium counter, you probably know you don't need to eat salt to go overboard on your sodium levels.</p> <p>Sausages, snacks, fast food (e.g., French fries), and ready-made products (e.g., frozen pizza) have a lot of salt added.</p> <p>Recommended intake: < 3750 grams</p>	<p>A large amount of salt in the diet can cause high blood pressure, leading to an increased risk of cardiovascular disease and stroke. The high salt content in food is 1.5g per 100g, and the low salt content is 0.3g per 100g. Always try to choose the lower salt product.</p> <p>Recommended intake: < 3750 grams</p>

E. GREETINGS_WELCOME

For all NL levels

Scenario – first time user
<p>Hello \$user_name</p> <p>I am Avobot, I will be your personal nutritionist and can help you understand your nutrition stats from MyFitnessPal better.</p> <p>I can also provide you with additional information.</p> <p>For example, you can ask me, “How many calories did I eat last week?” or “Why do I need protein?”. Cool right?!</p> <p>So, how can I help you today?</p>
Scenario – recurring user
[Hi \$user_name Hi there 🤖]

[How can I help you today? What do you want to know today?]

F. GREETINGS_GOODBYE

Scenario
[That was a nice chat. Talk to you soon. Bye! Nice talking to you.... Later Have a good day!]

G. ASK_CLARITY

Scenario
[I don't quite understand that. Can you repeat it, please? I am not sure what you mean. Can you rephrase it? Hah?! What do you mean? I didn't get that. Can you rephrase it?]
Did you mean sth like this? <ol style="list-style-type: none">How was my protein intake yesterday?What was the food with the highest calories last week?
Why do I need to consume sodium?

1. Attribute values

Attributes	Values
\$user_name	retrieved from MFP
\$nutr_1	(protein carbs fat sodium sugar)
\$nutr_2	(protein carbs fat sodium sugar)
\$nutr_1_value	retrieved from MFP based on the nutrient
\$nutr_2_value	retrieved from MFP based on the nutrient
\$nutr_1_value_target	retrieved from MFP based on the nutrient
\$nutr_2_value_target	retrieved from MFP based on the nutrient
\$nutr_1_value_percentage	calculated based on \$nutr_1_value and \$nutr_1_value_target
\$nutr_2_value_percentage	calculated based on \$nutr_2_value and \$nutr_2_value_target
\$nutr_1_value_sup	calculated based on \$nutr_1_value and \$nutr_1_value_target
\$nutr_2_value_sup	calculated based on \$nutr_2_value and \$nutr_2_value_target
\$food_group_1	(fruits & vegetables grains protein dairy products fats & oils)
\$food_group_2	(fruits & vegetables grains protein dairy products fats & oils)
\$food_example	more_protein = (chicken salmon eggs Greek yogurt quinoa black beans turkey peanut butter pinto beans lentils) less_protein = (vegetables like tomatoes, broccoli, leafy greens fruits like apples, bananas, pears, peaches grains like rice, oats, rice, pasta) more_carbs = (vegetables beans nuts and seeds 100% whole grain breads brown rice pasta) less_carbs = (bread rice pasta potatoes cereals) more_fat = (avocado olive oil eggs nuts nut butter fatty fish like salmon, tuna, sardines)

	<p>less_fat = (processed food oil margarine cheese sausage biscuits, cakes, and pastries)</p> <p>more_sodium = (ready-made food sausages salt potato chips frozen pizzas canned food fast food)</p> <p>less_sodium = (ready-made food sausages salt potato chips frozen pizzas canned food fast food)</p> <p>more_sugar = (unprocessed food in-season fruits sweet potatoes nuts & seeds)</p> <p>less_sugar = (ready-made products, salad dressings sweet drinks such as soft drinks sweets and pastries)</p>
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C Interview protocol

Interview protocol – total duration (appr. 30 minutes)

1. Introduction (3 minutes)

- 1.1 Small talk, asking how they are doing and if they feel comfortable (are you feeling stressed?).
- 1.2 Permission to record the video/record voice.
- 1.3 Introduction to what the study was about.

2. Main questions (25 minutes)

Interaction with chatbot

- 2.1 Did you enjoy interacting with the chatbot?
- 2.2 Tell me which feature you liked the most.
- 2.3 Tell me which feature you found the most useless.
- 2.4 Tell me one specific time you used the chatbot and why it was.
- 2.4 What other features would you like it to have?
- 2.5 (What did you think of feature A/B?)
 - Provide an overview of macros and calories per day or a particular date range.
 - Provide information for a particular macronutrient or calories.
 - Provide information regarding top/min food consumption.
 - Provide general information about a particular macronutrient.

Knowledge gained

- 2.5 Did you gain any new knowledge about nutrition? If yes, specify.
- 2.6 Do you find it a helpful tool to understand nutrition and improve your diet?

Literacy & text-tailoring

- 2.7 Was the text provided understandable?
- 2.8 Was the text provided satisfying? Would you rather have more/less information provided?

General

- 2.9 Would you use the chatbot in the future? Would you consider it a nice addition to MyFitnessPal?
- 2.10 Any other comments or thoughts?

3. Ending (2 minutes)

- 3.1 Closing thoughts/ Thank the participant

D Interview transcriptions

Interviewee 1

Researcher 0:04

Yes. Perfect. Okay, so how do you feel? Are you stressed?

Interviewee 0:13

Yes. I mean, with the thesis. Yes.

Researcher 0:15

Okay. And I guess you were a bit stressed also in the past two weeks, that you were also doing the experiment?

Interviewee 0:23

Yes.

Researcher 0:24

Okay. So you did the experiment. And actually, I saw but you were using the chatbot almost every day or every day? At least one?

Interviewee 0:38

Yes. Yeah. I think every day, maybe there was one day that I didn't. So I'm not sure

That it was. There was one problem one day there was also a problem. So yes, but I didn't know if it was because it was done or if there was about,

Researcher 0:54

but in general, I think you did very well, you interact as you should. So did you enjoy interacting with a chatbot?

Interviewee 1:07

Yes, I would say in general, yes. It was more user friendly than I expected. Although there were some things that I don't know if there were there, sometimes I didn't know if the information retrieved was of the date? I asked. So, yeah, it would be good if the chat bot acknowledged that he understood the date I want, for example, the date from this day from what you ate on this day was this. Okay. And then there was some things that I thought were a bit misleading. Because, for example, my one day I had a protein, I had a 50 grams, and I should have had almost twice as much. And the Chatbot said I was doing fantastic. So that was I think I was misleading on to my view on how well you're doing if you only pay attention to what the channel says. So not the actual numbers.

Researcher 2:23

Okay, so you've spotted the problem? And you would say that in this case, you would prefer not to mention numbers?

Interviewee 2:33

I don't know. I think I think the numbers are important. Because at the end of the day, it's Yeah, I think that it's important for the user to know exactly how well or how bad it is. And yeah, if the child would have said, Yes, we are you are doing fantastic on the protein, I would have thought I was doing 80% of my protein intake, at least. But it wasn't in less than half. So yeah, I would either to be better the the ranges,

Researcher 3:14

The numbers might have been off in some cases. And you said that you it was more user friendly than you were expected. What do you mean by that? Was it the UI in the WhatsApp implementation? Sorry, was it was the user interface of it or what made made it for you more user?

Interviewee 3:35

Ugh I don't know the way you form sentences, let's say, because we also had a how to make a chatbot for one course, and it was pretty lame. So this one was more, I think more. So probably the way it communicated.

Researcher 4:05

Okay, so maybe more intuitive with human communication. It came more natural interact with it?

Interviewee 4:15

Well, I wouldn't say intuitive, but it felt more natural to talk with him that we think.

Researcher 4:26

Wow, that's a different question. What do you think? Was it the boy or a girl? Or did you think that there is a character behind of it?

Interviewee 4:33

Now that's really okay.

Researcher 4:36

Do you think if there was a character with it, it would like you would be more intrigued to interact with it?

Interviewee 4:46

Not really

Researcher 4:47

For example, somebody proposed that if the Chatbot had also their own nutrition characteristics, and somebody would ask the chatbot about what did you eat and the Chatbot would Like, "Oh, I did this and that for protein". Maybe the user or viewer in this case would be more intrigued to keep on working on your diet or trying to beat the chatbot in this sense.

Interviewee 5:16

well, that could be interesting. I didn't really think about that. But yeah, I agree that asking for direct advice on what to eat would be nice a nice feature to have. Yeah, I don't know you through characterization or personification of the chatbot? But yeah. Like, what do you do? Or

how can you eat more protein? How do you use on cards? How do you? Okay, I can see that. Some people will find it more. easier, easier to interact with or to engage with.

Researcher 6:02

Okay. So the other question. I would like to ask you if some feature was, if there is a feature that you really liked, from the, like, few features that the chatbot had?

Interviewee 6:21

Yeah, I liked that. It gave me information on what the nutritional nutrition sodium is for what proteins are for. Yeah, I like that. But I, and I believe I won't even I won't even need to give any more information actually, all the way. Why is it bad to be too much of this wasted? But too much of that? And not always? It not always had, it had only a very basic information, which is good. But then I was curious about it. And I looked it up by research data, or Yeah, that's a nice thing to have.

Unknown Speaker 7:06

Okay. Yeah. And was it some feature that you felt that it was useless? Or? I mean, there were some features that were not working.

Interviewee 7:13

So it's not? The production is not? Can you hear me? Can you repeat that? Up?

Unknown Speaker 7:22

If there was some? Okay. One, two, yeah.

Interviewee 7:29

Yeah, I was fine. Yeah.

Researcher 7:30

If there was some feature that you found the most useless or that it was not that good, let's say.

Interviewee 7:47

Useless or are not that good? Well, I think it could be improved. The one thing I said the way the Chatbot retrieves information, it could because if it gave you or some that it acknowledge what date you're asking for. It says the what you ate on this date was this and that, because I was never sure. And I sometimes I thought the data was wrong. Because I thought I had eaten a different amount of proteins, and I actually never checked it. But then others were very similar, very several days in a row. And I thought my tuition was very different. Okay, so yeah, I was not sure that it was the right information.

Researcher 8:48

Okay. So if it was, as you said before, if the date was provided awesome text, improve your security about you. Yeah, you're exactly. Okay. That's a nice feedback. So do you have one moment or like one incident? Do you remember interacting with a chatbot? That?

Interviewee 9:19

Like good or bad? or anything?

Researcher 9:21

Both, like bad either fine?

Interviewee 9:25

Well, the ones they said I couldn't say the what was it?

Researcher 9:44

Well, the one that you talked about that? You found it weird that the nutrition it's, you can also say this incident, the fact that you thought that the statistics that it's giving you are not really in alignment with what you've Thought you had, for example?

Interviewee 10:02

Yeah, yeah. Yeah, I can't say that. I mean, yeah, this, I think it's three things that I was not sure that the data was accurate. And I could not verify exactly because I, I didn't or I didn't Well, I could verify. But I just needed. Because I, if I asked you to tell me all the last week, this was another feature, you'll end up asking about how I was doing, how am I doing? Or how am I doing this week? Something like that. I don't know if it's taking also, I don't know if it's taking the last seven days, or if he's thinking last week starting? Yeah. Yeah, from last week from Sunday to Monday, or Monday to Sunday. So that's one thing than the other thing is that the, the incident or when he told me I was doing really well, protein wise, with some other thing, when I was actually below half of it. Yeah, and the other thing is the when I was asking you to tell me about what carbs are for what proteins are for what sodium is for, etc, etc. Those where was it?

Researcher 11:32

Yes. I see. Now, some other questions, I would like to ask you out of the interaction with a chatbot. Was if you think that in general, you gain some knowledge about nutrition?

Interviewee 11:49

Well, Yes. But I cannot say it was because of the Chatbot. Well, I mean, it was through the chatbot. But it was the first time I counted calories. And I didn't know actually, that some of my meals were so caloric. So yeah, I do.

Researcher 12:10

Yeah. Okay. So at the same time, understand that even if you just use MyFitnessPal, you would probably get the same information or knowledge.

Interviewee 12:22

Yeah, because I mean, when you enter the data, you already see it right away in the in the app. Yeah, that makes the Chatbot redundant,

redundant for to know what, what your calories of your food are for. But I guess the added value would be to ask more general information about your nutrition throughout the week throughout the workflow time. Yeah.

Researcher 12:56

Well, do you think that it would be if you would integrate the Chatbot into the MyFitnessPal? Do you think it would be better for example?

Interviewee 13:10

How? For example by entering food?

Researcher 13:14

I mean, in any sense, like a feature in the chatbot that is integrated with MyFitnessPal. Good. Yeah. Either could be there. logging your food with typing?

Interviewee 13:28

Maybe for low food logging would be useful? Because it would be prepared maybe. But in the end, yeah. But actually, MyFitnessPal also has a function that you can enter in bulk or the ingredients of something. And you can also look it up. So I think the childhood would only put an interface to that. I don't know, it may have some good, I could say you have a limited or limited? Good. The improvement would be very limited. I would say.

Researcher 14:16

Okay, and in regards to if the Chatbot keeps on providing you report your nutrition report in a text format? Would you prefer this or like, do you think it would be a nice addition in this case?

Interviewee 14:37

I think maybe it would be a nice, I think a nice feature to keep you providing you a nutrition report in a text format. The next feature would be for example, if the Chatbot sends you a reminder that, hey, you're doing low on sodium, you're doing low on protein and you should eat more maybe, but I find it not so convenient having to interact with the app through a chatbot I think that yeah, to receive notifications, maybe it's nice to have a chatbot. But not when you want to look up a lot of things, I think I find it more natural and more effective.

Researcher 15:23

Okay. So, okay, I asked you about the knowledge that you gained? Do you find it helpful tool? Okay. Yes. If you consider the chat bots to be a helpful tool to understand nutrition?

Interviewee 15:47

Um, yes. Slightly helpful. I can say.

Researcher 15:55

assume I assume that you already have enough knowledge that you think that, like, it didn't offer you to great extent, some new knowledge?

Interviewee 16:06

Yeah, not not real knowledge, but it's more insights. Yeah, I mean, I didn't know exactly what the recommended amount of calcium is. But this is something that the Chatbot can inform you about? It's telling you well, you're doing very, very bad on this. So it's, in a way looking this up for you, which you may overlook. So in that sense, I think it's useful as it can do the, you can do the checks for people who are not acting for us of these and that nutritional specifications. I don't know what to say. So in that sense, yes. I think it's, there's some value in that.

Researcher 17:05

Okay, yeah, I understand what you mean. To kind of close up, I have, like, two more questions that are about the text that was on the chatbot. If you thought that it was understandable, apart from the fact that you miss the dates?

Interviewee 17:26

Yeah, no, I think it was understandable. The that was one of the things that I liked the most. Actually. It was very user friendly. Etc.

Researcher 17:38

Yeah. And do you think I mean, okay, I see that you're satisfied with this. But would you prefer to have less numbers shown or some, like simpler vocabulary used?

Interviewee 17:53

No, no. If anything, I would add more numbers. Okay, no.

Researcher 18:01

Okay, that's a nice to hear. Or like interesting. I think I'm pretty much done with the questions. So we'll just ask you if you have any other comments or thoughts that you would like to add?

Interviewee 18:18

No, I think you covered everything.

Researcher 18:25

Okay, then I will stop the recording. I think we're done. Thank you.

Interviewee 18:32

Okay, good luck.

Transcribed by <https://otter.ai>

Interviewee 2

Researcher 0:00

Okay, so I hope you're feeling fine. And how are you? Are you relaxed?

Interviewee 0:09

Yes. Yes. For this no in general.

Researcher 0:14

Okay.

So I am going to record it. So you consent on that. And we're going to talk about the experiment that you finished. And in general, what was your impressions? And did you enjoy interacting with a chatbot for example?

Interviewee 0:33

I mean, yeah, it was it was enjoyable. Just Well, apart from the few times that I had problem with account, I think

Researcher 0:46

there was a problem for one day,

Interviewee 0:47

yes, a couple of days. I had that. But yeah, I mean, in general, I cannot say that I didn't like it chatting with the bots.

Researcher 1:02

Was it some feature that you liked the most, let's say?

Interviewee 1:07

In the bot or the app? Well, I liked that. It was given his suggestion, like, when I was always starting, like with Hi, whatever. And then it was replying. And then you can also ask me this or that, for example. And I think it's useful, because if you asked me now, what do you would like to know about your nutrition? Like? I don't know. Like, especially. I'm not really into it. So I don't know anything about it. Yeah. So if you'd like, if it makes the first step kind of, it really helps, because then I serve with one question in everything. Oh, but I also want to know this, and then also that,

Researcher 1:53

okay, so that's really nice. Yeah, I see. Okay, so it was helpful, helpful for you?

Interviewee 2:00

Yeah, definitely.

Researcher 2:01

And what do you think there was a feature that was the most useless?

Interviewee 2:14

feature that was the most useless? I don't know. Like, what do you mean, like features?

Researcher 2:28

Like, there were some basic features that describe what was implementing, like, providing you the full report or providing you about your protein or giving you information about one particular? What is protein? Where is it coming from? Yeah. So I mean, there are not many features, but do you think there was something that was like, This doesn't make any sense?

Interviewee 2:54

I think sometimes I was asking, Okay, with protein was working, I think also with carbs. But then I think I was asking like more the general things like, maybe the question didn't make sense, but like how many? Like, I don't remember. I remember if I asked for, am I eating enough vegetables or something? Or fibres? I think he couldn't answer.

Researcher 3:31

I mean, fibre is something that is not on the top five nutrients. I think so it is not trained to answer this. So this is something that you would like to have, right? Yeah.

Interviewee 3:42

Like, in general. Okay. I don't know if it also suggests because the chatbot or is it was just a report what you were eating in the past weeks?

Researcher 3:54

suggests on how to eat better you mean?

Interviewee 3:57

I mean, yeah, exactly.

Researcher 3:59

Well, it is doing this to some degree, but a more advanced version would be like to fully understand and of course provide vitamins and every other minerals and stuff that are needed for nutrition. Yeah, so on the first level, it is just suggesting probably to eat more veggies and fruits.

Interviewee 4:23

Oh, yeah, it was doing that. And actually, it was it seemed to me to eat more carbs. And the one I also liked, but probably because I forgot some meals, to be honest.

Researcher 4:40

What was your goal? Do you remember what was your goal if the weight keeps the weight?

Interviewee 4:44

Keep the weight

Researcher 4:44

Yeah, you are not interested to I don't know you lose or gain muscle. So do you remember some example that was memorable, but like, really? You were like, Whoa,

Interviewee 5:00

Um, yeah, I thought I was eating too much carbs. But then I was wrong. I was eating the right amount because in the first days like, I think this the first three or four days I was like, always. And then I send the some meals I forgot them. So probably also I was in deficit of calories for the first day. Yeah, I was fooling everything. No, I said I was, for example, eating not enough protein or not enough or too much carbs. Yeah, but no actually did say that it was correct. Okay, so that was nice.

Researcher 5:47

Okay, so to finish a bit, the discussion about the Chatbot. Particularly, is there some feature that you would like to have in the future? Like, how would you think about it as an extension or in the future?

Interviewee 6:03

Yeah. Like me? Maybe, It doesn't include like fibres or? Yeah, so like, extend that. So I don't know if he does it on fruits, these kind of things.

Researcher 6:23

I think you were suggested to have vegetables or fruits, but no, particularly no more examples of what exactly you should eat.

Interviewee 6:33

Right? Yeah. So like, maybe be more specific. Like now probably it was only on micronutrients. Yes. So but then I'm thinking you should eat less red meat or more white? White.

Researcher 6:56

Okay, so you like it to be more specific and more specific on the food? Okay. Okay. Good.

Interviewee 7:00

Yeah. Also, because like, people don't reason about macronutrients. So like, if you tell me, you have to eat one and 100 grams of protein and you say, okay, but I don't know, like, you know, so maybe it's nice to know if you're in deficit or not, but not too much specific on micronutrients. Be more like, human like, I don't know. Okay. More red meat. I think it gives an indication but...

Researcher 5:30

yes. So would you actually prefer a mix of like, examples and numbers? Or just examples?

Interviewee 7:46

No, not mix?

Researcher 7:48

Mix? Yeah, yeah. Okay. Yeah, that's nice. That's actually very helpful. So did you think that the text that you were provided was understandable?

Interviewee 7:58

Yeah, yeah.

Researcher 7:58

Yeah, you would understand everything? And well, I think we can you kind of explained now that the text was satisfying, like, or more like a mix of more examples with some numbers would be fine for you. And maybe some more advanced vocabulary would be okay for you or keep it simple?

Interviewee 8:23

No, I think if you keep it simple, it's it's better. Yeah. It is. If you are, I don't know what you mean with advanced but like, if you had more like nutritional vocabulary, maybe it's It may sound confusing. I don't know, for normal people,

Researcher 8:45

yes and no. So there were like differences in the text. And some texts involved advanced words, like mentioning only protein or carbohydrates. And some people actually do not really know what they are about. Yes. So would you prefer to keep it on a low and a simple level?

Interviewee 9:05

Let's say, well, actually, if you want it maybe to be like it...I don't know if I mentioned that a that I'm speaking with my nutritionist. Yeah. Maybe I want him to be specific in the use of vocabulary about nutrition. So if my nutrition is a chatbot, I also might take it more seriously. If it use this kind of vocabulary. And then if I don't know what that means, I can just ask the chatbot, okay, I'm not. I'm not saying that it's more or less informative. I'm just saying about the impression that I have about the chat.

Researcher 9:57

So maybe you prefer something that is actually more that adaptive in both cases. So he would he would start talking about protein and then

you like, "Okay, what is it actually?" Then go into more simple vocabulary and explain to you what is...

Interviewee 10:15
Yeah, exactly.

Researcher 10:16
And maybe you understand also. Yeah, yeah.

Interviewee 10:21
If I take if I take it seriously, and then if it suggests me, you have to eat more of these less of these, then it's more probable that I will do it. No, if I'd say okay, but as it's writing here, of course, it's like pre script, something. I don't think it's usually personalised.

Researcher 10:42
well, I mean, it was kind of personalised to your nutrition. So up to some level, I assume you took it more seriously. If somebody would give you just a report of with random numbers, like...

Interviewee 10:53
no. Yeah, um, so yeah, I'm just saying about an impression that I may have.

Researcher 11:06
Yeah. So as you told me before you there was this incident that you found out that you actually you were eating okay. We got into the carbs. Yeah. Do you think that after this unique experience with the chatbot, you gain some knowledge about nutrition?

Interviewee 11:23
Yeah, no, not feeling guilty if I eat every day pasta, because everybody's saying here that I'm eating too much. No, I know that it's not. I will keep eating.

Researcher 11:41
Was it some other knowledge you gained?

Interviewee 11:46
I remember that. I asked some like, why? I remember just to try what are proteins, but then I tried with some other vitamins. But I don't remember. Yeah. Have a really bad memory.

Researcher 12:02
Well, it is not trained for vitamin, so any kind of vitamin wouldn't work?

Interviewee 12:06
Yeah. I don't know. I asked something. But then I don't remember. Like, I didn't know exactly what something meant. Okay. See, what is this? Okay, then? I don't remember. I think it was at the very beginning.

Researcher 12:24
I will take it on the record. Yeah. Okay. So you think it was helpful? And do you think that something like that would be would work in the future?

Interviewee 12:39
I mean, for people that want to keep track of this? Yes. Yes. Yeah, definitely. Also. Ya know, another thing that that is helpful is that you have the notification. I don't know

Researcher 12:55
The notification that was coming every day.

Interviewee 12:57
Yeah, I forget about that sometimes.

Researcher 13:03
Yeah. But you forget, because let's say it was part of the experiment. If you were an actual user on something like that, you would like to have a notification reminding you to check on your nutrition.

Interviewee 13:18
Maybe at the beginning, probably I don't know. Like, I'm trying to imagine because I don't think I'm eating bad. So I never felt like the urge to keep track of everything. I always thought, Okay, I'm eating fine. But if I have to imagine somebody that really want to keep track of it. I would say that first you need to build that habit. So you need the notification. Okay. Okay. And then after a while. You just do it after every meal probably.

Researcher 13:53
Yeah, I mean, then the notification is partially to initiate the conversation with you, but you could always text him anytime you want.

Interviewee 14:01
No, actually, I was thinking about the app. Okay, then. Then the bot maybe not every day, but it's nice to have it every once in a while, two times a week.

Researcher 14:15
Yeah. Okay.

Interviewee 14:15
Yeah. Okay.

Researcher 14:19
But no I understand that the notification on MyFitnessPal is a good reminder even for myself. Yeah. Because I still have the application installed and I receive "Did you input your food?" I was like, "Oh,

Interviewee 14:31
so it's both so I would say for the for the app or after a while...but do you always use it?

Researcher 14:41
Like my fitness? No.

Interviewee 14:44
Okay, then I think at the beginning because I have a friend that she keeps track of everything. And I think she told me that at the beginning it she I kind of to force herself to do it. And then it was just natural. Don't you just do it?

Researcher 15:01
Oh, so she's she's doing it? Yeah, I was only when I was on a diet.

Interviewee 15:07
No, she do it. She did it just because I think she was feeling like tight or something like that. And she decided to keep track of it. And after a while she said, I feel better because now she eats less or more than that.

Researcher 15:23
She did her own study.

Interviewee 15:25
This was like months ago.

Researcher 15:30
Okay, so you think a chatbot would be a nice addition to the MyFitnessPal? If it was integrated for example?

Interviewee 15:38
Yeah. It's it keeps you like engaged? Yes. In the app. Yeah. Otherwise, so it would be so boring just to input your food. Yeah. And it's easier to just ask. Like, also with the app it's a bit, it's not really intuitive where to search for things. And yes, also to other to learn,

Researcher 16:03
Especially the new UI, because I found myself self struggling the other day as well to like input the food, they changed the UI recently. Yeah. Yeah, it's a common problem of the application like logging your food.

Interviewee 16:21
But so yeah, like, it's way easier to just have somebody and ask. It takes two seconds. Yeah. So yeah, definitely.

Researcher 16:33
I mean, right now, we're talking about the chatbot that you text. But a different concept would also be voice recognition, like the say, if the Chatbot is trained to reply to you, like even a chatbot with a voice recognition would be even simpler, right?

Interviewee 16:51
It's just faster and more precise. Very, because if I don't know where to search, yeah.

Researcher 17:02
Okay, nice. So any other comments in general?

Interviewee 17:09
No, I don't think so. No,

Researcher 17:15
some comments about the experiment or stuff like that. I don't know.

Interviewee 17:24
Yeah, as I said before, I have no idea what to ask about nutrition so many times, after, like, different shoe questions. I was like, man, now what should they? So for us, maybe it's just for some people, but for those people make more suggestions. I don't know how you can regulate these. I think for some people like me, it's better. Yeah, if the bot started the conversation,

Researcher 18:01
okay, if the bot breaks the ice, yeah. Okay, but I get what you mean maybe also, like have as a preference setting the preference of how you like it to treat you. I believe also, this would make more sense and be more convenient to the use of it. Yeah. Yeah. Okay. I think that's all I wanted to ask you. Okay. Thank you for participating.

Transcribed by <https://otter.ai>

Interviewee 3

Interviewee 0:00

Currently, I'm a tutor. Yeah. I teach English for children.

Researcher 0:11

Okay, nice. So how did you hear about the research? Where did you find it from?

Interviewee 0:23

Yeah, I am sometimes wandering around Facebook, Twitter and Reddit, and I saw something about the project. So I applied to your case.

Researcher 0:38

Okay. And so, in general, I'm going to ask you some questions about the Chatbot. And then some other ones. So for a starter, did you enjoy interacting with a chatbot? I see that you used it almost every day, I think.

Yeah, I really enjoy the Chatbot really like an advisor? What I need to contain my nutrition, my eating habits, I go to a chatbot and asked what do I need to eat?

Yeah. So do you think there was some feature that you liked the most?

Interviewee 1:33

I usually check in the progress from like, in the last days, the last few days. And it shows the detail of what I have each and is it good or not? What I need to improve? Yeah, that's what I like about a chatbot. And like, one more thing is the Chatbot can give me the introduction like what do I need to eat? To improve my wage? Yes, like that.

Researcher 2:19

So the that there were examples of food to eat. It was good for you. You like this?

Interviewee 2:32

The chatbox tell me that I have to eat more. Something less. I have to reduce this right. I consume, like at chips and some something that junk food is not good for our house. As a teenager, yeah. Okay. I mean, I bring like my favourite. Drinks is Mabuti. You know that right?

Researcher 3:02

No.

Interviewee 3:06

Bubble tea like, Muti and they put some topping in it is a very popular Yeah.

Researcher 3:13

Okay, I see. So you drink a lot of it. And let's say it is nice if he tells you to reduce it or drink more healthy drinks.

Interviewee 3:27

Yeah, healthy like suddenly with a hydrating smoothie, like apple juice and orange. So improved my vitamin C. Yeah.

Researcher 3:44

Okay. And was there some feature that you didn't like on the chatbot Something that you found useless?

Interviewee 3:54

Sometimes the Chatbot like, is it require me to type the command again to use it. So it was a bit uncomfortable.

Researcher 4:10

Okay. Yes, I understand. And do you have one incident that you remember that something went good or wrong? Or it was you're surprised that it would give you advice for example instead of Yeah, something something that you remember that there was oh, yeah, it says this is strange.

Interviewee 4:42

For example, I eat like a lot of different food every day. So it might be controlled because my parents designed the food. What I literally every day, okay, and when I knew I was really trying to follow the instruction. And I find it hard to be frugal, because as I said, my parents decided,

Researcher 5:21

yeah, fine. It's hard to decide what you eat of course. Okay. Interesting.

Interviewee 5:31

I think you saw what I have at the diary, right?

Researcher 5:35

Actually, no, I didn't. But now that you're asking, I could check, but I will do it afterwards. I would like to ask you if there are other features you would like the Chatbot to have. Like, did you ask something that it couldn't give you an answer?

Interviewee 6:00

Let me think. I think it should have a tower of nutrition. It's like, like a pyramid with what you should eat. Yeah, category.

Researcher 6:21

I see. Okay.

Interviewee 6:24

So the full. Yeah, I think that's all I need to add that feature.

Researcher 6:36

For example, some people are asking, "What should I eat?" But this is a bit too general. It's hard. You would like to also have this feature.

Interviewee 6:49

Yeah, my daughter in Vietnam usually gave me that tower. Yeah. So I think the child must have it too.

Researcher 7:00

Okay. Yeah, I see. That's interesting to hear, I didn't think about that. So I'm going to move to some other questions now out of the Chatbot. Did you think you gain some knowledge about nutrition?

Interviewee 7:18

Yeah, before I use chatbot, no one would advise me, as far as like you should reduce the fat and the junk food you consume every day. But the chatbot when I asked it, it set out my ship reduce my sugar consuming. Yeah, I eat a lot of sugar every day.

Researcher 7:48

So you think you learned something about it from it?

Interviewee 7:52

Yeah. And I am trying to fix that. And drinking less sugar.

Researcher 8:05

Do you think it was helpful to understand how nutrition works for example?

Interviewee 8:15

Yeah. Is useful a lot up and let me check it. For example, when I used it. Yeah, I use, we check every day like it's I am lower than my target. And I mentioned that salt and carbon. Keep on this good level, and sugar and fast also. And I find it really useful, and I'm proud of myself.

Researcher 9:02

So it also boosted your confidence that you were doing well at that point. Yeah, that's nice to hear. Because there is a lot of problems with the way that it talks. Sometimes it is demotivating people to continue because they think that they are doing bad. So in this case, it worked the other way around. So you think that the text that was on the chatbot, you understood everything, did you have trouble? Or was it complicated for you?

Interviewee 10:14

Let me see. No, I don't see any problem because these thing like calories and fat and you know? Yeah, no.

Researcher 10:39

Yeah. So do you think that you could if the vocabulary was more advanced you would also understand for example, if they were more numbers

Interviewee 10:53

The numbers?

Researcher 10:54

Yes. For example, some other group of participants had the numbers. So it would say you are 50% lower than your target. Would you like that? Or do you prefer what you had with I think it was simpler.

Interviewee 11:12

Yeah, I can understand that. No problem

Researcher 11:14

I'm just asking if you would be ok with that. What would you prefer for example?

Interviewee 11:31

So you are saying that in a group of participants, they tell me that I'm lower than my target 50% ?

Researcher 11:47

Yes, so the text had numbers or it would say "you had 200 calories less today keep on eating more" or something like that. Or it was using more complicated terms. So sometimes people don't like this because they say "I don't know what it is. And I don't care. Just tell me what to eat." So I'm asking you, what would you prefer for example?

Interviewee 12:23

Like I can fully understand so if someone tells me to eat something more to improve my way or my hands are my nutrition. I can Yeah, I can accept that.

Unknown Speaker 12:48

Yeah, you understand? Okay, so that's most of the questions I think I wanted to ask you. If you like the if you would use the Chatbot in the future if it would be more advanced also.

Interviewee 13:11

So it will improve?

Researcher 13:14

If it improves you would keep on using it across I mean, I saw your email so I'm sure you liked it.

Interviewee 13:28

I like it and like It's my habit every day I every day I use My FitnessPal and log in my breakfast my lunch my snack and yeah.

Researcher 13:41

So if the chat bot was not on WhatsApp but it was part of the My Fitness Pal, you would also like it.

Interviewee 13:49

yeah, I like it.

Researcher 13:50

And what would you like it to tell you? What, for example, tell you if you're doing good or bad or give you other information too.

Interviewee 14:12

you mean a chatbot is combined with my fitness pal?

Researcher 14:15

Yes.

Interviewee 14:19

I would like to have my fitness overview in the main screen. There's our target, like every day for you to follow, like what you have to eat. And if you reach the target of that day, it will tell you Yeah,

Researcher 14:49

yeah. And would you like to, for example, if you could log your food through the chatbot instead of using the application?

Interviewee 15:02

No I prefer...

Researcher 15:03

Oh, you like it at my fitness pal? Okay.

Interviewee 15:07

Most of people will agree with me that they will like using us more like, yeah.

Researcher 15:16

Yeah, that's the problem. But sometimes it is more efficient because I think that it could be more like your friend that you're texting to, let's say. So that's all I would like to ask you if you have some other thoughts that you would like to tell me.

Interviewee 15:47

I think the chatbot needs to be fixed. Showing poetry messages. Like, sometimes it locked me out.

Researcher 16:05

Yeah. Sorry, I didn't understand this. You mean?

Interviewee 16:12

I mean, the Chatbot sometimes is automatic and totally disabled. So I need to try a poetry.

Researcher 16:21

Oh, I get that. Yeah, that was probably because it was let's, let's say a test application. So we have some problems. But if it would, if we would fix it, then I think you wouldn't have this problem. But yeah, but that's a good note to write down. That's all I would like to ask you. Thank you very much. And I was just wondering now, do you think you could send me some screenshots of what you were texting with a tugboat?

Oh, okay.

Interviewee 17:03

I can No, no, I can already. See what you text it because I am analysing this text. But I'm going to if you could send me the screenshots. I will use them on my report. And that would be nice. But that's up to you. I will remove everything like I will remove Of course your name if it is somewhere.

Oh problem. I will sign it to your email.

Researcher 17:31

Yes, whatever is convenient for you. Yes. That would be nice. Okay. And, yeah, that's all Thank you very much. I really appreciate it.

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Interviewee 4

Researcher 0:02

How are you feeling first? Uh, you, like in general, if you are stressed or relaxed these days, I assume because of the thesis.

Interviewee 0:17

Yeah. Me today's a bit stressed.

Researcher 0:22

Okay. So as I said, I would like to ask you if you enjoyed interacting with a chatbot like in general? Do you want to elaborate on this more?

Interviewee 0:42

I liked interacting with the chatbots, I always find it interesting to see how much a chatbot can do or cannot do. I also find it pleasant that it was like sometimes I got a message in the evening, like, Do you have any questions for me? And I was like, Yeah, let's, let's see how yesterday was or last week was only the last time I got that message. I didn't have time on that moment to respond to it. And then I didn't respond to it, then. I didn't interact with it anymore afterwards. And because it didn't send to you messages, because I was too long away from Chatbot.

Researcher 1:30

Yeah, yeah. But there was actually some kind of problem because of the sandbox. But yeah, I was expecting this. Is there some feature then that you really enjoyed? Like, what did you like the most from it?

Interviewee 1:47

Overview of you yesterday, because it was a lot of information at once. And it really gave a nice overview.

Researcher 1:57

Okay. And was it something that well, I asked if it's the it was the most useless but or probably something that you didn't like about it?

Interviewee 2:14

Not sure. I also noticed kind of casual way of talking and Smiley's and I intimated also a bit. So, yeah, the most bad was that it was not perfect, but you already knew that.

Researcher 2:34

Yeah, as I told you, it's kind of a prototype. So it's really hard to implement something that's really good in this amount of time. But some of the features that you mentioned to me that had a bug, I was kind of already aware with it. So yeah, I couldn't, because now the experiment is running. I couldn't fix it, and then give a different experience to the rest of the participants. Everybody had to have the same conditions. So do you think there was one time that you used it that you that you remember that you would like to tell me about something that really surprised you or something that really disappointed you, for example.

Interviewee 3:22

It's a bit related to bug fixing, but I was really testing it out, like asking as much as I could think of, and then it first was like this, and this is on the correct level, but this in this is too high. And then the next message was this and this is correct. And this and this is high, but then sugar switched. So yeah, on time, calorie was fine. And then maybe fats or protein. So we switched a bit around, but in the like, overview kind, you could also see like, the numbers, and then see how much you did and how much you should do. So that clarifies it a bit.

Researcher 4:17

Okay, yeah, but let's say you found it confusing that from one one message was like telling you this, and then the second message will tell you exactly the opposite.

Interviewee 4:28

Yeah, yeah. Yeah.

Yeah, that's make sense. It would be confusing.

Also, there was one thing like, I ate meat or something, and they said, this and that and this and that. And then maybe you should eat less fruits. Hamburger isn't the fruit so I was quite confused by it.

Researcher 4:52

okay. Yeah, this doesn't make sense indeed. Okay, I see Uh, okay, yeah. Is there like other features you would like to have on this Chatbot? Something that you were asking it and it couldn't reply to you because it didn't have there wasn't trained for it?

Interviewee 5:15

Yeah, maybe something like vitamins, I am interested in and then vitamin C didn't know yet. But of course the protein and fats and calories are there. Yeah, maybe even. I'm not not very interested in those micro things. But for me, maybe, along with the daily message, like, do you want to interact with me maybe already give? Like the overview?

Researcher 5:53

Oh, so instead of a notification, just giving you an overview already?

Interviewee 5:57

Yeah, that's probably the thing I would ask the most. Yeah, yeah.

Researcher 6:06

Yeah, that's a nice idea, actually. Okay, so I'm gonna move to some other questions. For example, if you get if you think you gained any knowledge about nutrition, by interacting with a chatbot, or even with just using my fitness pal

Interviewee 6:26

a bit, I guess, because now I know that proteins and yoghurts are a bit similar, but also in meat. I was not very knowledgeable about that. But I have like, two in a row knowledge. Yeah, I would say, that I gain a bit knowledge

Researcher 6:51

Not too much. Yeah. So you found it helpful that it could give you like this kind of information, for example?

Interviewee 7:00

Yeah. Also, I did really take notice on it, but also like, normal calorie intake, normal protein intake per person. I wasn't aware of that. But now, I could be aware of that.

Researcher 7:17

Okay, are you interested in general in nutrition? Or you don't really care about your diet let's say?

Interviewee 7:23

Yeah, in general, I don't really care. I just like food. But because of that, I am a bit interested, because I want to reduce a bit of calories.

Researcher 7:36

Okay, I see. So do you think that this experiment helps you kind of like, would you continue to use the application? Yeah, I

Interviewee 7:45

I was considering to maybe still use it because it was nice in like, Greek yoghurt all day or have so many variants. And if you have clicked it once, you can find it earlier. So that was quite nice. But like, evening, the dinners. It's quite a hassle to put in everything like One potato, two potato made like this made like that. And if you have HelloFresh, or complete meal from the supermarkets only reheated, then it's a bit difficult to put in every thing in the fitness pal.

Researcher 8:33

Yeah, yeah. Well, for the good for the HelloFresh I think yes. But for the supermarket. I thought, I don't know if you saw that you can scan the barcode, actually.

Interviewee 8:44

Oh, no, I didn't notice them.

Researcher 8:46

Yeah, you can do this, and then it makes it a bit easier. Then you need to only adjust the portion. But that's a different scenario. So do you think that for example, if you would integrate the Chatbot into the My Fitness Pal, it would help you? Like, would you consider the nice addition?

Yeah. And do you think for example, if this would be the case, do you think that it would help, for example, to log your food? Would you like to like log your food through the Chatbot instead of like having to type it in as my fitness pal?

Interviewee 9:30

Possibly, yes. I'm not sure how it would look exactly, but the idea sounds nice.

Researcher 9:38

Yeah, I mean, one way could we also voice recognition because it's out but it's not only texting, but something like that. Okay. And, yeah, I have some more questions about literacy in general. If you found the text that was provided on the chat bot easily to under easy to understand.

Interviewee 10:04

Yeah. Certainly.

Researcher 10:07

There was nothing that was confusing for you. And would you like? Yeah, so it was satisfying? Would you rather have more information or less information? Text wise, though?

Yeah. I would say more information, but then eventually, I might get a bit bored of all the information.

Yeah. For example, a different group of participants had much more numbers using during the text, or think they had examples of foods to eat instead of I think you had food groups only? So would you rather have, for example, more food examples, specifically asking telling you to eat more? I don't know, watermelon, or more peppers, for example.

Interviewee 11:10

I think it's a difficult question. Because when I hear I should eat watermelon. I will be thinking about watermelon might be buying it. food in general, I think I prefer like food groups. So you don't have to make that specific decision. Then again, if it's food groups, you don't think of one specific item to buy or eat.

Researcher 11:37

Yeah, yeah, I see. And also there was this other category that they were not given any examples, for example, they were only given numbers would something like that? You didn't wouldn't like this?

Interviewee 11:52

I guess not. I think it's quite helpful if they suggest something you should eat. In addition, or instead of?

Researcher 12:03

Yeah, actually, some participants were asking, What should I eat? I don't know if you also ask this. But do you think a question like that would satisfy you if that chatbot could answer it? Would you expect it actually to, to answer you do such a question?

Interviewee 12:24

I think it would be nice if you could ask such a question that maybe not specifically for me, because I already eat too much. Then what should I eat? In addition to that, and they say?

Researcher 12:40

Yeah, I think it was within the flow of a conversation. Maybe they were asking, and they chatbot was saying that it was he should eat more of something. So probably a follow up question was What should I eat? So I think this is these are in general, the questions I wanted to ask. As a final question is, are there any other comments that you would like, Tell me about it?

Interviewee 13:08

I guess not. Because the Chatbot I found it nice. It had some bugs. That was a bit of pity, but overview and the numbers and examples still be exciting. I liked it. Yeah.

Researcher 13:27

So I suppose in general, you're satisfied to the extent that this first implementation can satisfy you? Yeah. What do you use it in the future?

Interviewee 13:41

Possibly. I am not too certain because well, I might get bored and not interested in proteins and calories, but you maybe the app, because it gave you like the calorie daily intake. And I've set a goal for myself to lose weight, and they say you have to eat this amount of calories. And when I put everything in, I can see if it's close to death or not. But then I also connected it with my step counts. And then sometimes it gave really weird stuff, like you said today 22 steps, and that makes you you can eat 600 calories more. Yeah. And then I was like, 22 steps is not 600 calories, but I also didn't take 22 steps. I took a lot more. So that was fusing.

Researcher 14:47

That's actually confusing. Maybe there is some problem with synchronisation. Okay, that's interesting to know. Okay, yeah. then that's all I had to ask. Thank you very much for your time and for the experiment participating. I think you probably received today some other email. It's the last questionnaire. It's the same one as before. I'm just making a comparison.

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Interviewee 5

Researcher 0:00

I like to ask, how are you these days? If you are stressed, for example?

Interviewee 0:08

Like today, or just in general, as I've been filling out the or participate in the study,

Researcher 0:13

well, both just in general, you're experiencing some stressful if you're stressed these days in your life, and particularly right now as well.

Interviewee 0:26

Yeah, so I took probably, like, two weeks ago to write when I started, like, logging everything. My boyfriend and I actually broke up, so....

Researcher 0:40

I'm sorry to hear that. I think I'd say you're pretty stressed recently. Okay, I see. And today, how's it been? Well, the day just started for you. Right? Or it's the afternoon.

Interviewee 0:58

It's like the late afternoon now. It was fine. It's super hot. So did not really go outside for too long.

Researcher 1:07

Okay. That's good to hear. Where did you find the study from by the way?

Interviewee 1:13

I found it on Reddit. There's like a post on there that says like paid studies, and they posted two different opportunities. Okay.

Researcher 1:23

Okay. So one of the main questions I would like to ask you is, in general, if you enjoyed interacting with a chatbot.

Interviewee 1:35

I was a little doubtful on that, because I did like, reach out and ask different questions. But I did not always get like a response. And so I don't know if maybe I just like wasn't asking the correct questions that like would trigger a response. Or if I needed to wait, because I think most days, I got like a message from the Chatbot saying, "Hey, do you have any questions for me today?" And so I'm not sure if I had to, like ask them in that window when I was reached out to or if I just like wasn't saying the correct trigger words.

Researcher 2:07

Okay. Yeah. So in most of the cases, you are not sure if you have done something wrong, or if it is the Chatbot stupid. I see. Okay. Was there some particular feature you like the most for example?

Interviewee 2:29

Um, I think I liked the fact that they reached out to me because sometimes I would forget. And even sometimes, I'd be like, Oh, I forgot to like log in my food and for the day. But I also like, how, if they were saying like, this is how many like grammes you like a protein you have left for the day, or like, this is like the percentage of like, your sodium content that you've studied like that. They're like, tell me where I'm at. And like, give me that data. But at the same time, like I said, oftentimes it didn't actually answer my question. But yeah, it did have like useful information, like pulling from the app, but did not necessarily answer.

Researcher 3:10

Okay, yeah, I see. And was it like, some feature that you found useless? Or? I mean, you're telling me that in most of the cases, you were not sure. So this pretty much answers the question too, right. Yeah. So do you remember any particular moment that you used it, and it was more memorable?

Interviewee 3:40

Um, yeah, so it was one of the days that I had just like eating a lot of sodium. And so just like getting that number back was a little alarming. And so I think that was like the most memorable part because I had already known I was like, I eat Brahmin for breakfast that morning, and that's always filled with a lot of sodium.

Researcher 4:03

Okay, that's interesting to hear. So did you think okay, you thought about it because you saw this and did you cut down on this day for example, because you thought that you already had enough of soja.

Interviewee 4:19

I'm not gonna lie. I ended up just eating poorly the entire day because I was like, I already ruined it. And like I said, I had just like gone through a breakup. So the past like two weeks I kind of have either not really been eating much at all or I'm just eating so much or I'm like, having like more alcohol if I like go out with my friends than usual. So it was just like a little monkey past couple of weeks.

Researcher 4:46

I mean, I can imagine it has been a very up and down diet for you, I guess. Do you by the way did you happen to log the alcohol as well?

Interviewee 4:57

Yes, I did. Oh, wow. It was it. I guess it was dropping the like, it was making it even worse, right? Yeah. What was the alcohol? Obviously, I probably didn't log it super accurately. Like, tried to the next day I'm like, like, what did I drink?

Researcher 5:18

Yeah, I think I had tried it also in the past and it was very restricting.

Interviewee 5:24

Yeah, it's super alarming when you see like, oh, man, like, that's how much isn't a gin and tonic?

Researcher 5:30

Yeah, exactly. Okay. Back to the Chatbot. I guess I would like to ask you what further features you it would you would like it to have?

Interviewee 5:44

Sure. Um, so as far as I can tell, like a lot of like, the questions like that you ask about is it's like, how much if I consume like, what's the difference in like, number difference in consumption from like, last week to this week? I think I would like to have the option to just like, hear more nutritional information. Like if I had a question like, What what's I'm trying to word this correctly. Like, if you could ask them a question saying like, Hey, what are some good protein sources? And then maybe you get like a list of high protein foods or like a link to, like some articles that like can bring you to Google or something? I think that would definitely be a feature that I would want. That's actually like some of the questions that I was asking. And that's when I later figured out that that's probably not the type of questions that I'm able to ask the chat bot.

Researcher 6:44

Okay. Yeah, I see. One second, because I need to check, because I had my participants splitting groups. So you had the group that you were provided with numbers, and well, only numbers, actually. And advanced vocabulary, let's say. So you told me now that you would prefer to have even like more details about nutrients and more even more information. Yeah, I see. Okay, that's nice to know. So do you think you gained any knowledge from the interaction or the information that was provided to you?

Interviewee 7:45

Oh, I don't think I gained any more information from the Chatbot than I could have gone into like the MyFitnessPal app myself, and just did there. I think.

Researcher 8:02

Yeah. Did you try any of the questions that it was like? What is protein? What? Why do I need protein? And these kind of questions?

Interviewee 8:12

I didn't not ask that question.

Researcher 8:15

Okay. Because these could give you some answers, for example, why you need proteins. But again, it is limited, and it depends on to what extent you want it. What kind of information you want it. But yeah, in this case, I think this is where it differs from the MyFitnessPal application, because there it can only give you the stats. So do you find it helpful to understand nutrition?

Interviewee 8:46

Yeah, I mean, I think especially now, it's really big thing that people are getting really into nutrition, or at least as far as I can tell, like whenever you scroll on tick tock, I see everybody talking about, you know, like the macros in their food and like counting calories and being in a calorie deficit and lifting. So I think it's definitely useful information to be able to track that. And my fitness pal makes it really easy to track everything and the amount of people that like input data there makes it easy to find the different foods that you're eating. I think having access to the chat bot makes it super easy. Like just to be like, hey, like, like how many grammes of protein do I have left for the day? And you know, it can just drag it from where you have it? Yeah. Yeah. Sorry. Am I explaining this?

Researcher 9:38

Yeah, no, I understand that it is more easily accessible compared to something else, for example, to answer your questions much easier than using it from the app, for example.

Interviewee 9:48

I'm sorry, can you repeat that again?

Researcher 9:53

The accessibility in the Chatbot is better than using the application?

Interviewee 10:03

Yeah, I think that's easy. I know that like that for the Chatbot, it went through WhatsApp, yeah, I think would be like super. I don't really use whatsapp all that often. But I think, like if I were able to just like open up my messages and be like, hey, like, what else do I need to do today to reach my goals and just having it send me a message back? That's super convenient.

Researcher 10:28

You don't use WhatsApp as a main social media to talk with your friends?

Interviewee 10:35

The way I talk with my friends, just like the Messages app on the iPhone or like Snapchat are the two that I use the most.

Researcher 10:44

Okay, so it's not WhatsApp. The number one?

Interviewee 10:48

No, no, it's not.

Researcher 10:49

Okay. And do you? I'm sorry, this is probably because I have grown up in Europe. So social media platforms are different than us. What is the number one platform in us that it's currently used for messaging? Apart from iPhone?

Interviewee 11:10

In the US, as far as I know, just between me and my friends, the only two that we use are like Snapchat and the built in Messenger app.

Researcher 11:21

Okay. Yeah, I see. Okay. Yeah, that's mostly Yeah, that's interesting to know, just in case for future development, because the chatbot could be adapted to other platforms that the users are more familiar with. So I have two more questions, which is about the text that it was provided, like the chatbot was developed in some, with some text that it was adapted to the groups of the participants that I had. So for you, in your case, do you think that the text was understandable that what you were provided with? You could understand it easily?

Interviewee 12:01

Yeah, I think like the communication wise, the information that was given to me was easily to be understood.

Researcher 12:09

I mean, you're also a native English speaker, so the text that you were provided with was satisfying. And would you rather have less information? Well, you kind of answered to me these. But in the case that in the group that you belonged, you had a high numeracy, for example, you were provided with a lot of numbers. Was it something that you liked? Or would you prefer less numbers? Like I simply a text in that case?

Interviewee 12:45

I didn't mind the numbers. I think more information is better, especially when it comes to like nutrition and everything. Yeah. Okay. Yeah. And especially because it sounds like it was concise enough that I wasn't like scrolling through to get all the information, but I always say more is better.

Researcher 13:04

Yeah. Okay. Actually, I heard this from another person as well. That belongs to your group. So it's interesting to see now. Okay, do you think it would be a nice addition to MyFitnessPal? For example, if those two things could be integrated two together?

Interviewee 13:25

Oh, I don't know if I would use it if I'm being honest. But I'm sure others would. Like, I think it's a feature that would be nice to have in the app, but I'm not. I don't think I would use it in the future.

Researcher 13:43

Okay, okay. Is it because you don't use MyFitnessPal? Or why would you not use it, for example?

Interviewee 13:54

Um, honestly, I am, like a very I know, it's not like an actual person on the other side. I know, it's like a bot. But I am very content with I use my fitness pal. I'm not always the best with it. But I'm very content with just being able to, like look at my daily diary and see where I'm at, in that sense, because you can scroll down and there's like a little like nutrition tab that you can go there. And I'm pretty content with just using that.

Researcher 14:23

Okay, so you're telling me that basically, you're satisfied with application and as you said, you know that it's a chatbot and not a real human so you prefer just the application itself. When I have to ask you, if it was not a chatbot or it was a nutritionist, replying to you back would you go to that then.

Interviewee 14:52

I know it's a chatbot not a real person, but I'm like relatively Like, independent. So I've always felt like another person that I'm going to. But like I said, I'm content with being able to do things on my own. And even though it is a chatbot just the interaction with something on the other end, I don't think it's necessary for me.

Researcher 15:19

Okay, no, that's interesting to hear, because I understand you only need the report and you seem that you understand your needs in regards to intuition. So you don't see probably the necessity to have somebody telling you what to do. Would you rather also, okay, I know that I understand that you wouldn't be a big fan of the textbook. But in the case that you had it an additional question to the text that you were provided? Would you also like to have food examples, for example?

Interviewee 15:55

Um, what do you mean by food examples, like meal ideas?

Researcher 15:59

Mostly like when other groups had food examples, for example, you should eat more vegetables or fruits, and even more details, like you should eat more watermelon or more potatoes?

Interviewee 16:15

Yeah, I think that's kind of what I was getting to earlier when I was asking certain questions to the chat bot, and I wasn't necessarily getting the response that I expected. So I think that's a feature that I would have liked to have in the experience is, like I said, one of the questions I asked is, you know, what types of foods can I use to get more protein? And I just didn't get a response for that. And I would have liked to.

Researcher 16:45

Okay, I see. Okay. Yeah. Okay, I think these are mostly the questions. So I wanted to ask you as a final is like, if you have any comments in general about the experiment, or the chalkboard or anything you would like to tell me

Interviewee 17:09

um, I think I kind of hit on everything with my experience with the Chatbot.

Researcher 17:14

So you're fine. Okay, then I think that was it pretty much. Thank you very much for participating. And I understand it's a very tough period for you. I hope all the best for you and that's all for me.

Interviewee 17:31

Okay, awesome. Thank you.

Researcher 17:32

Thank you. Bye.

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Interviewee 6

Researcher 0:03

Yeah, thanks for joining. How are you feeling in general these days? Or when you were doing the experiment? Have you been stressed in general? I don't know if you're also doing your thesis too?

Interviewee 0:19

Some pretty stressed Yeah.

Researcher 0:22

Make sense. And when is your deadline?

Interviewee 0:25

It's in about a month, I think.

Researcher 0:28

Oh, great. Same as me. Nice.

Okay, so I understand where you are. And so, yeah, let me start with the questions about the experiment, or like, the interaction with a chatbot. So did you in general enjoy interacting with it, for example?

Interviewee 0:53

In a sense, yes. My camera does that sometimes it just connects. There we go. Okay.

I liked sort of the idea of interacting with a chatbot. I have never really done that, like, you know, you have those things on websites, where you're like, Oh, can I help you? I'm a chatbot would be boo. But I never, I never really used any of those. So for me, it was sort of a new experience to have, especially because it was over WhatsApp, which is like, I, I'm really used to over WhatsApp, that you're talking with a person you know, so then it's kind of weird to have that same interface. But then it's above, which did make me a bit cautious at first. So I was like, Yeah, I don't want to send some some random person accidentally, some random message about. It was a bit reluctant. But it was fun to sort of see a response and have the, the Chatbot react to what I was saying. And I like that.

Researcher 1:59

Yeah. Okay. Yeah. Interesting. That mentioned about the WhatsApp thing. I assume at that point, you kind of liked it that you were familiar with the interface?

Interviewee 2:11

Yeah. It was like the first step to actually start communicating with it, or like, oh, is this gonna go go? Right? So it worked out?

Researcher 2:22

And did you in general, do you care about your nutrition?

Interviewee 2:27

It's one of those things where you're like, I should care about this. And I want to, like, look more into it and put a healthy meal plan together, like, but then you have life happening. And I live with two roommates who are who don't really care about that stuff. So I feel like I might also get some ridicule from them. If I start like min maxing my entire food schedule.

Researcher 2:55

Oh, yeah, of course, I understand. I was just wondering, because there are people that care about it, and they're not. And this kind of affects, if they want to talk with a chatbot, for example. Yeah. So I was wondering, but I think I noticed that you were very, like you were entering your food data almost every day? I think. So you're pretty good as a participant. So do you know, could you tell me some features that you like the most, or you found the most useful, interesting, for example.

Interviewee 3:35

I, the feature I felt was most useful was the fact that you could ask, like for a specific type of nutrients over any specified period of time. So that's like the app, we had to enter the food stuff in. That's a nice overview of per day for your total nutrition and that sort of the categories, but it was only for like, a day or a week. And for the chatbots, you could just ask it, which was for me, he's here then. Sort of trying to look it up.

Researcher 4:09

yeah, yeah. Yeah, that's nice. That's actually quite the difference, I guess. And some feature that you didn't like at all, or you found useless?

Interviewee 4:22

Well, not necessarily a feature, but I had some trouble figuring out what I could ask. You gave a number of examples in the email, and those worked, of course, but then, sort of I tried experimenting a tiny bit with another type of question, and then I got an answer, which was not an answer to the question I asked but to a different question. So then I got a bit confused.

Researcher 4:54

Okay, I see. Yeah, well, it is not the smartest...

Interviewee 4:59

thing But sort of, it was difficult to explore it. I felt like so I'm not sure if there was like a way I didn't even try that. But like, usually if you have some kind of chat commands, you can type like help and you get a list of commands you can use.

Researcher 5:17

Yeah, you're right. Yeah, that's something I didn't think about implementing. But I'm gonna note it. So did you have some particular incident? You remember to tell me either good or bad, for example.

Interviewee 5:36

I can look up the one where I'm not sure what it is. I felt like it wasn't that weird of question. Here it is. Oh, by the way, I really doubt that it's just copied the foods from the app, because the message isn't English. All right, I asked about potassium, because that's one of those, you know, science words I know in English. But then it was like, Oh, good job. You are big enough calories. And I was like,

Researcher 6:28

okay, yeah. Okay. That's strange that it recognised something. Yeah. It's not what it should have recognised.

Interviewee 6:40

It's probably what's like, Did I eat sufficient food and just ignored the potassium or something. But,

Researcher 6:45

yeah, yeah, okay. I will note it. I think that there were many people that were trying to get more nutrients, but it was very limited. So that's what many people are also interested to have? Yeah. It is what it is. In regards with, like, the knowledge, do you think you gained more knowledge about nutrition?

Interviewee 7:17

I don't think I really learned a lot about like the nutrients themselves. But more so an insight into how much of each I'm consuming. For example, we tend to have a thing where when one of my roommates isn't here, or your brother when both are gone, and I'm here alone, we get pizza. Because it's easier than cooking for two people. But then, you know, you realise, okay, this is really bad for me. But also, like, in general, when you eat like potatoes, vegetables and meat, we are vegetarian, so we don't eat meat, but you know, meat replacement. Just more insight in what you were missing when you're only eating fat, compared to like, a different meal. I thought that's very interesting, but not really about the nutrition itself, I think.

Researcher 8:16

Okay, yeah. Well this kind of answers also my other question, which was, if you found it helpful to to improve your diet. But so you gained more realisation and an insight on what is on your diet.

Interviewee 8:37

Yeah. Well, also, because, like, on packages of food, there's like the Nutri skill thing, which is quite new, I think, in another instance, least. But I always find that very well, it doesn't really give much information other than that says, Oh, this is not the healthiest choice in this category. But the categories feel so arbitrarily selected. So then actually seeing what's in there in the clear overview. We're also the table Delta, like, you're probably shouldn't need this because this is really bad for you in terms of Gatorades or

Researcher 9:15

Yeah, I mean, the bot is retrieving data from the application as well. So yeah, the labels, the labels on the packets could be more insightful.

Interviewee 9:29

Because you have also the extensive labels, which are much like the large graphs on the back or tables on the back, but I've never really took an effort to understand the those or look at them, because it's the there's always like, Oh, for 100 grams, it contains this. And for one portion, which is always some totally weird number, I feel like it contains this, but having the application and the Chatbot where you're just saying Okay, I drank like half a carton of milk. And then it just tells you this, isn't it? This is like this is a second thing. No need to calculate all that drink, drank 200 millilitres, another 200 millilitres and under 100 calories. Okay, I like that was really nice.

Researcher 10:19

I see. And what about the texts that you were provided? Was it understandable for you?

Interviewee 10:27

From the chatbots? Yeah, although I some of the longer messages, especially when you asked about a certain nutrient. For example, if you're like a pretty long message, or when you asked about, did I eat enough calories this week or something, if you're pretty long message. To me, it's formatted nicely with like, bar graphs, which was nice. But I feel like if you're using WhatsApp might as well make set for messages, which just sort of feels more natural. If you have like, a couple of seconds to read the first and then the next bullet up. Maybe that would be nice. I'm not sure.

Researcher 11:12

Yeah. So like, break the text into message message message? Yeah. It makes sense. And do you think that less information would be better? would be more satisfying for you?

Interviewee 11:38

I don't necessarily think so. It's like, it's, it's good the way it is, although, let me just look at one again. Think it's fine to like, like, it's, it's not too much. But it does provide the information you're asked for. But it's not like you have to read through an entire book together. So that's nice.

Researcher 12:05

So would you even like to have more? For example, there were other groups of participants that had less text, and less numbers? Would you rather have these? Or would you rather have even more numbers?

Interviewee 12:22

I think I'd like it to be like this, and then maybe have an option to like get it can ask it ask you a question. Do you want to see more statistics or something?

Researcher 12:38

Yeah, okay. And I think you also you were in the category that you didn't have any food suggestions? Would you like that?

Interviewee 12:53

That really depends on on how that would work. Because I don't like cheese. And as a vegetarian, you get a lot of cheese recommended stuff. And then some meals where you take out the cheese, it's just isn't as good as I imagined as it would be normally.

Researcher 13:13

Yeah, to be fair, the participants' diet was not taken into account. So when it came to suggestions, it was everything. But a better implementation of it would be take into account if you're vegetarian, vegan, or anything, and adjust those recommendations. So but on a first level, because you didn't have any recommendations, would you prefer to also have this index some people had, for example, food groups, instead of you should eat more veggies and fruits, instead of you should eat more potatoes and cherries today?

Interviewee 13:56

I think that would be sort of general pointers. Like, be aware that you need to eat more vegetables to have a healthy diet because you're not eating enough. Like that would be nice, I think, specific meal recommendations. They also include like saying, hey, maybe you could try eating, I don't know, indian curry or something. But it'll include that or...?

Researcher 14:20

It was up to some detail. Like, not specifically food, but like, you should eat more brown rice.

Interviewee 14:32

Right. Now that I think that would be nice.

Researcher 14:37

Okay, yeah, and some final questions. I would like to ask if you would use the chat bot in the future. I know that you're not a user of nutrition applications if I understood correct. So probably the answer is no. But if this exists is it something you were interested in? Would you use it in the future?

Interviewee 15:05

I might I would maybe. I'm not sure if I would have it in the I'm thinking sort of the main reason I think I wouldn't use it is because I have to sort of go to it and ask like stuff. Maybe if it would be, if it would send me like, every week or something a message like, "Hey, good job, huge, blah, blah, you should try to do this." And then you can chat with it to get some more information. I think maybe then I would use it because then it sort of gives you a, it makes you think about oh, right, I was working on my diet and eating healthy and stuff.

Researcher 15:46

So you were receiving a notification, right? Or no?

Interviewee 15:52

From the Chatbot? No, I was from the application, the application was constantly like, "Hey, you should enter your food."

Researcher 16:00

Okay, then you are probably interacting with the chatbot already enough? Because there was a scheduled notification every day. It is probably because you interacted with it already. Okay, in any case, you say you prefer if the chatbot took the initiative? Yeah. But I get it, of course, you would forget about it anyway. And so would you consider also the chatbot a nice addition to the MyFitnessPal application?

Interviewee 16:48

Yeah. Yeah, like I said earlier, it's, it can provide a nice overview and a way that the application, well, maybe you can do, but you have to click through a number of things. And then just talking to a general term, "Hey, show me this" and just immediately give you the information you want. That's really nice.

Researcher 17:09

Okay, these are all the questions I want to ask you. Do you have in general, any comments or thoughts about it?

Interviewee 17:17

Oh, well, it was a lot more fun to participate than I initially thought. Like I said, it provided a nice bit of insight into well, what I eat every day. And I, I was sort of surprised by the MyFitnessPal app that you can actually scan products, which is really nice, because I do not want to be entering all the different stats from all that stuff be very convenient.

Because that was one of the things sort of holding me back. I felt a bit for about downloading such an app just because I was curious. But then I was like, Nah, it's gonna take up way too much time to put everything in there. So I will probably want to we did it for like two days. But yeah, for this one I've managed to do for like three weeks now or something.

Researcher 18:11

Thank you very much for your time. I know that has been hassle for many people to actually follow this. But I think that from the records you were one of the best participants. I wish I could give you awards.

Interviewee 18:26

Yeah, and I did have some trouble with the instructions. Like we emailed about it where the link didn't work and like I said it was also just because I was a bit 'scared' is big word but reluctant because I was like I'm not sure how this is gonna work.

Researcher 18:42

So then you are satisfied. Okay. Yeah, thanks for the participation.

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Interviewee 7

Researcher 0:00

I'd like to ask you where you found the research from.

Interviewee 0:06

I saw it advertised online somewhere, but I don't remember where at this point.

Researcher 0:10

Okay, no problem. And are you in general interested in nutrition? Or why did you sign up?

Interviewee 0:20

I more interested in wanting to monitor my health and diet, because I think there are things I can do to improve.

Researcher 0:30

Okay, so in general, yeah, we have some trouble with your account and the Chatbot. But after we went through this, did you have an overall good experience interacting with it?

Interviewee 0:47

Oh, yeah. I mean, obviously, there were some technical issues at first, but yeah, once once I was able to, like start being able to ask the questions, and I can pull data from my account, it was helpful, especially because it could break down things like how much sugar did I eat today? Or how much salt today today? Or what's the recommended amount that I should have this or that? So it was helpful?

Researcher 1:10

Yeah. So it was a good experience in general, like you, you liked it, you were satisfied with it let's say?

Interviewee 1:20

it's a good experience.

Researcher 1:24

And is it some particular feature that you liked the most?

Interviewee 1:29

Um, I think just the fact that I can respond pretty quickly. So you know, that like, you don't have to wait for, you know, a few we're working with a normal nutritionist, you don't have to wait till they get back to you via phone or email. But this is pretty automatic.

Researcher 1:47

Okay, so you're enjoying the fact that, yeah, it can act as a nutritionist, but you don't have to wait, basically.

Interviewee 1:54

Yeah, it's like, it still won't be the real thing. But it's a good option if like, you know, you're kind of in a time crunch. Or you really need like a spur a moment, like information about how you know, how this fits into your daily diet that you might not be able to, like, know, off the top of your head, you know?

Researcher 2:19

Yeah. And was it some feature that you found the most useless or you didn't like it? You didn't find the purpose of it?

Interviewee 2:29

I'm not particularly there wasn't anything that like really frustrated me or like, make me feel okay. Just like that.

Researcher 2:42

And can you describe me some moment that you used it? And you were like, Oh, wow, what is it saying this? Or something that you remember out of your head? Some incident? Let's say?

Interviewee 2:56

Um, no, not really. I mean, it was mostly like, pretty straightforward. I would like ask it for things like, you know, how many calories should I still consume today? Or like, how big should my dinner be? Or things things, things of that nature? And its responses always kind of like applied to what I was saying. Sometimes we wouldn't necessarily understand the question. I was asking him, but I would just like, rephrase it, eventually give it away.

Researcher 3:27

Okay, yeah. Okay, and about the knowledge, do you think that you gain some knowledge through this interaction with a chatbot? Like about nutrition? Did you learn some stuff?

Interviewee 3:41

Definitely. I definitely learned how my kind of day to day diet operates. Because I think when you were kind of taught constantly talking to someone about what you eat, even if it's like AR AI powered, I think it forces you to be more conscientious about your food decisions.

Researcher 4:01

Yeah. Okay. And also, did you learn something about the nutrients? Did you ask questions about them? I don't know.

Interviewee 4:11

Not really in depth about the nutrients no.

Researcher 4:17

Okay. Do you think it helped? I mean, it's a short amount of time, but do you think it helped you to make some changes in your diet?

Interviewee 4:27

Definitely, like I said, being able to have anyone to talk to you that can hold you accountable, even if it's artificial intelligence is better than nothing. I think it's like an extra set of eyes on how you're eating and how you're handling your diet. So definitely helpful.

Researcher 4:44

So you feel like you became more conscious about what you have been eating and the means to if it told you today you had too much fat so you reduce the fat you had the next day or something? Yes, exactly. Okay, so now I'm going to ask you some questions about literacy, because the experiment was mostly about the text that the Chatbot provides to you. So did you find the text understandable? Like, did you have trouble? Understanding something?

Interviewee 5:20

No, I found it to be understandable.

Researcher 5:23

And you so there were some different groups of participants, you were on this group that had a lot of numbers included? What you were fine with this, like, showing you exactly the percentage?

Interviewee 5:38

Yeah. breaks it. At least that allows me to visualise more about would you? Yeah.

Researcher 5:50

If you would rather have also some charts and plots with your progress or something like that.

Interviewee 5:56

Yeah, that'd be great. I mean, I'm always I always feel like that sometimes you can kind of overdo it, like not all data needs to be visualised. But sometimes it's helpful because it allows me to like, kind of think through something in a different way or new perspective.

Researcher 6:10

Okay. Yeah. And also, some other groups had some examples of food groups of what they should eat, or specifically some food suggestions. Would you also like this, or you were fine, because in your case, you only had you had this and that calories. And that was it.

Interviewee 6:33

He said, food suggestions is nice. I mean, I definitely feel like, especially food suggestions that don't require, because I'm someone that's very busy. Or at least it's like, I feel like I don't have as much time to cook as others, like, I'm not really home all day. So maybe ways that you can kind of just say like your healthy foods, you should look to try to find it. And rather than it being like your recipes you can follow because like sometimes when I've worked on like a dietary thing, it'd be so much about like, just following a recipe book.

Researcher 7:06

And what about so these other groups had, for example, usually ate more apples and bananas, let's say when it came to because they had to eat more vegetables. Would you rather to have a chatbot? That, is that specific? With? Yes. Okay. Because Supposingly, you already saw the questions that you had at the beginning indicated that you had some knowledge about nutrition already. So the groups were still read in, for example, it seemed that you had this knowledge. So you wouldn't need to know. You wouldn't need an a chatbot to tell you what to eat, you would know already. So yeah, this is why I'm asking you if you would prefer to have full citizens. Okay, and I actually have two final questions, I would like to ask you, if you would use the chat bot in the future.

Interviewee 8:18

I would if like it could, I could ensure that maybe some of like the technical bugs I experienced. I didn't experience again, I did think there are some issues pairing mine with my, my right health tracker app, and but I think that's something that will just get resolved, the more that the app is, I guess worked with but I mean, I really liked it. I mean, I, in a sense that like, I guess I've actually worked with an AI I use an app for AI for mental health. So it's like a chat bot, but for I guess it's tracking my mood and behaviours. And so when I think about that chatbot like sometimes it would like if there's one function about that, I would like to see what this one is about sometimes unsolicited they like give it obviously provide data and as it tracks your mental health from day to day, but sometimes it also just provide random lessons. Like sometimes I have to enter the app and be like, Hey, would you like to learn a new thing about mindfulness today? And then you can click on yes or no, it has some stuff so that'd be cool. If like I could go and act as a nutrition chatbot and maybe like once a day could like provide some sort of like, health tip or health wisdom like I was I've like enjoyed kind of those, like educational opportunities, I guess.

Researcher 9:41

Yeah, like notifications more thing.

Interviewee 9:44

Yeah, exactly.

Researcher 9:46

Yeah, I see. Yeah. Yes. Yes, So, sorry, I think I skipped one question that I wanted to ask earlier. What other features would you like it to have?

Interviewee 10:09

I'd say like that, I'd say also for it to. Alright, I think there are ways to make it still feel like more human in certain ways. Because ultimately, you're just going to the app, and you would kind of be like, Do you have any questions for me today? And that was kind of always how the interaction started. So if there's a way where it could kind of be like, hey, Patrick, how's your morning going? Would you like to check in on one of these things, and then there'll be like, different options you can choose from. So if it felt almost more like, kind of a choose your own adventure kind of conversation, I guess it like, the more you can make it feel more conversational, which I already think it does, to some extent, but obviously, there's always more that can be done. I think that will be.

Researcher 10:57

Okay. Okay. And feature. What about features regarding, for example, right now, it would provide you an overview and some macros, I assume? Would you like to extend it to include vitamins fibres like more?

Interviewee 11:17

Yeah, I mean, the more granular I think, even if I don't like end up, like having having an understanding or use for all data to provide, I still think like, at least I'm someone were, the more I can sort of see, the better. I feel like I get a clearer picture of exactly like, what my health makeup is.

Researcher 11:39

Yeah, yeah. And, yes, so this was separate from my fitness pal. But would you consider it a nice addition to mfitnesspal? For example?

Interviewee 11:54

Yeah, it kind of like, MyFitnessPal doesn't really have this level of like, I don't want to say customer support, because that's not really is. But this idea of being able to speak with a specialist, or at least someone that can like do a scan or your profile and kind of like, present information from your profile in a way that's more digestible. And conversational, I definitely think is helpful.

Researcher 12:19

Yeah, yeah. And for example, would you also like to, if it was possible to like, log your food to the Chatbot instead of having to input it manually on the map?

Interviewee 12:34

Like if this could all just be done over WhatsApp with like, a conversation with this thing? I think that would be so easy. I mean, I'm all for like, consolidating communication from multiple apps into one app. If, if, if and when possible.

Researcher 12:52

Yeah. So one last comment is that you probably liked the interaction was happening through WhatsApp? Because yeah, I assumed it was it.

Interviewee 13:06

Yeah, I use whatsapp regularly. I mean, I have friends. I have friends that live overseas family, that's overseas, too. So it's like, that's our main way of communicating. Just because as long as you have Wi Fi you can message anywhere for free without having.

Researcher 13:24

Yeah. Okay. Any other comments you would like to say about the experiment that Apple does something?

Interviewee 13:33

No, I mean, thank you so much for letting me be a part of it. I'm always interesting. And yeah, thank you so much for meeting with me.

Researcher 13:47

No, thank you for your time for the experiment. Not for the interview now. I really appreciate it. And that's it. Good luck.

Interviewee 13:56

Awesome. Yeah. Thank you so much. Have a great rest of your day.

Researcher 13:59

You too. Have a nice day. Bye.

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