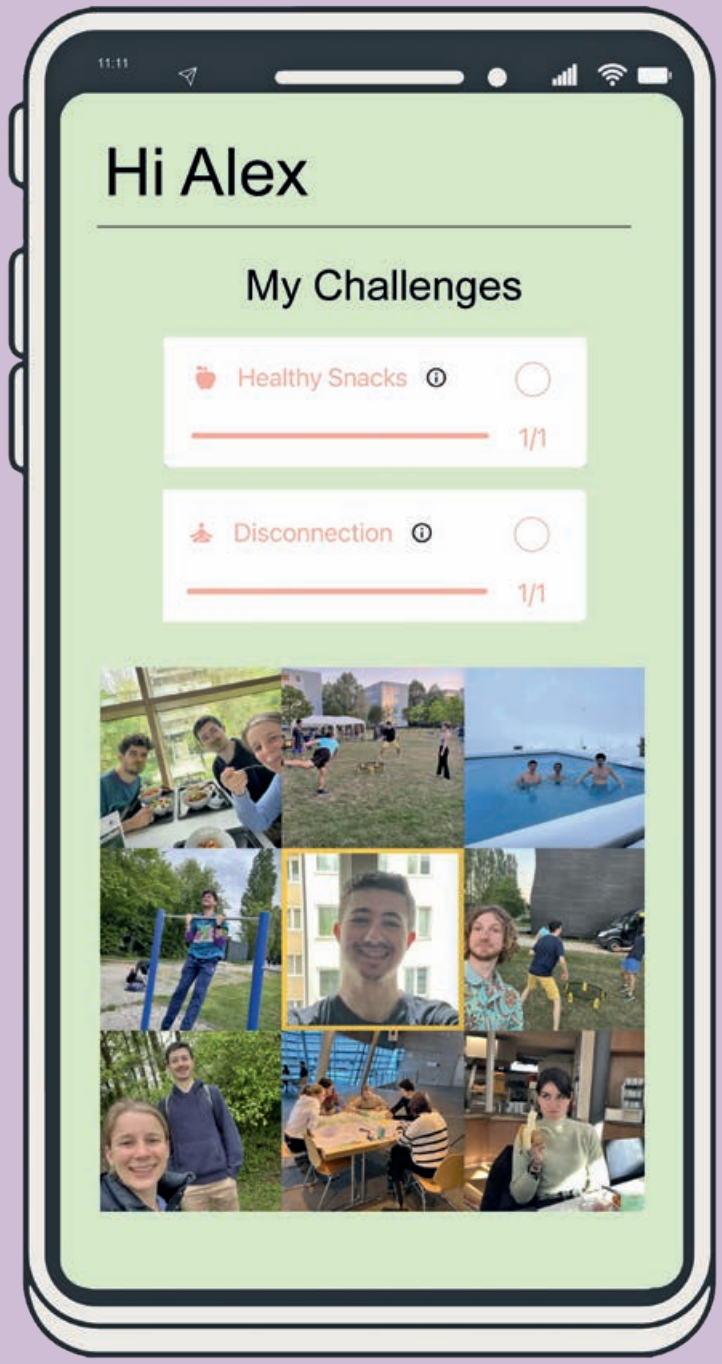

11:11
Hi Alex
My Challenges
Healthy Snacks
1/1
Disconnection
1/1

Research Report **Healthy Habits**

Why do we struggle so much to get rid of “bad habits” and at the same time build up “healthy habits”? What does healthy even mean? In today’s society, trying to find the right things to do can be overwhelming, and focusing on all of them is almost impossible. Our goal was to make building up “healthy habits” be fun and easy. In our project, we were focusing on daily challenges tackling different kinds of health: Physical and mental health, as well as nutrition. In order to gather concrete feedback, we built our own social media application in which users can set and complete daily challenges while sharing their achievements with friends and family through photos.

Team	Raluca-Ana-Maria Barna Moritz Friedemann Sandra Gross Helene Jung Camila Loaiza Santos Alexandra Cara Marquardt Flavio Principato Magalie Ross
Tutors	Jan Kochanowski Leonard Schmitt
Supervisors	Prof. Dr. Florian Röhrbein Prof. Dr. Volker Nürnberg

Preface by the Supervisors

Prof. Dr. Volker Nürnberg and Prof. Dr. Florian Röhrbein

As a supervisor, I have supported the “healthy habits” project with great pleasure, interest and passion. After all, it is dedicated to one of the biggest problems in our healthcare system: lifestyle diseases. As an expert in the Joint Federal Committee at the Ministry of Health, I am particularly involved with digital innovations. In principle, the healthy habits approach is very important for standard medical care! Challenges, gamification and low-threshold digital approaches are the right way to get “couch potatoes” moving. The goal is always an individual and sustainable change in behavior.

I would like to thank all the students for their extraordinary commitment and hope that they will remain committed to the idea of a healthy lifestyle; I look forward to staying in touch beyond the project.

Habits are automatized cognitive processes for decision-making. Within a particular context a stimulus automatically generates an impulse towards action, based on learned stimulus-context-response associations. This implicit type of processing information immediately yields a result while relying on minimal computational resources.

While healthy and not so healthy habits have been extensively researched in the fields of psychology, cognition, and neuroscience, they have yet to be systematically investigated in computer science! Data volumes are expanding at an exponential rate, and there is often a requirement for this data to be processed in real-time like in robotic systems. Against this backdrop, principles of habitual cognition present a promising alternative to resource-intensive planning algorithms, not only for humans but also for machines.

These thoughts go well beyond the scope of the current project I had the pleasure to supervise and I very much enjoyed being once more part of TUMJA. I wish everyone in my team a lot of healthy habits!

Supervisor insights

Prof. Dr. Volker Nürnberg

What is your research interest or motivation for science?
I would like to improve health promotion in all settings (at work, university, neighborhood, etc.) with innovations.

What was your best TUMJA moment?
I was able to invite the students to an event/congress in Mainz and talk to them all personally in depth.

What does mentoring the team mean for your own research?
The students think out of the box, are digital natives and represent social trends, which makes the collaboration mutually exciting

What special experience from your studies/career would you like to share with the scholars?
Careers are no longer linear, but disruptive. They are less predictable than they used to be.

How did your work as a supervisor influence you individually?
I try to move more in terms of the project. But I don't always succeed...

Supervisor insights

Prof. Dr. Florian Röhrbein

What is your research interest?
To me neurorobotics is an extremely fascinating field of research since it is at the intersection of neuroscience, AI and robotics. In my group at Chemnitz University of Technology we are trying to transfer insights about how our brain controls our body to artefacts like cognitive systems or robots. The many disciplines involved make this quite challenging but it is also fun!

What special experience from your career would you like to share with the scholars?
My career path was anything but straight. Moving from academia to industry, founding deep-tech start-ups, working for a corporate and eventually getting a professorship was quite some zigzag but I would be happy to do it again in the same way.

Picture your healthy journey

The alarm goes off, 7 a.m., it´s Monday morning, a little gloomy outside as Paul rolls over to hit snooze for another 5 minutes of sleep. When he reaches for his phone, a notification pops up from his friend Lisa. “Hey Paul, don’t snooze. Remember our new challenges on BeHealthy?” Feeling a little called out, Paul smiles to himself, turns off his alarm and opens his new app BeHealthy. He ticks off his challenge “Going to bed and waking up at the same time each day.” The app prompts him to take a picture of his accomplishment. “How do I show that I got up early in a picture?” he asks himself. Paul walks up to the window and takes a selfie in front of the rising sun. His face in the photo is smiling. In the app’s feed, he sees a picture of Lisa, smiling in the camera with her kettlebell, having already completed her exercise challenge for the day. Glancing over at his watch, Paul realizes he has some time left before his first lecture, so he pulls out his yoga mat for a quick morning yoga flow. “That was easy,” Paul thinks to himself, smiling as he ticks off his second challenge of the day.

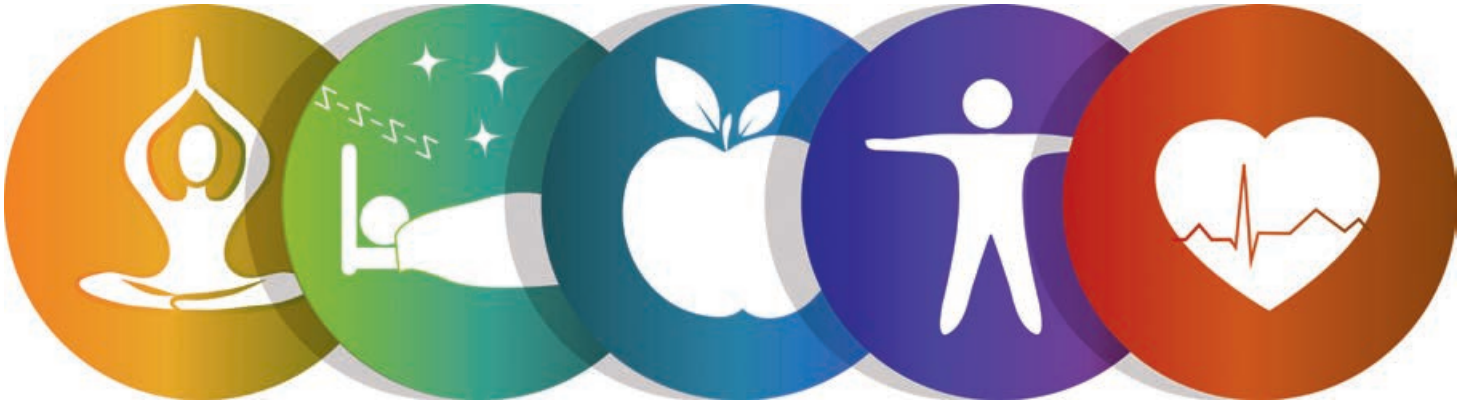
He leaves his house. Outside, his friend Tim is waiting for him. “Hey Tim. What a cool morning picture you posted! It will look great in our mosaic.” Both interested in maintaining good sleep hygiene, they created a BeHealthy mosaic together as an additional motivation. With every challenge one of them completes, the photo they take is added to the mosaic, so they are building it together. At the end of the year, the two have already made the plan to print out the whole mosaic as a poster and hang it on their wall.

BeHealthy is an app that was designed to help people build and maintain healthy habits in a fun way, together with their friends. It was developed as part of a student research project at the Technical University of Munich, interested in the healthy potential of social media. Everyone knows of the chaotic phenomenon of viral videos and internet trends, which can reach a large number of people. “Seeing your friend cook baked feta pasta might inspire you to cook the dish yourself,” says BeHealthy team member Helene Jung. Next to all the widely discussed and known harmful consequences, social media also helps people to gain knowledge of topics they would otherwise never have thought about, to develop social skills and to become an active member of society through creating and sharing content. However, one of the main critical points about social media are the hours wasted on procrastination with the help of social media apps, especially seen in young adults. (“The Effects of social media on College Students,” Q. Wang, W. Chen and Y. Liang, 2011). Considering this, the creators of BeHealthy wondered if there is a way to use social media´s positive effects and use them to cancel out its negative ones. With their project, the student team aims to answer the question of whether the key features of social media can be used to help people build healthy habits. Therefore, they designed an app, especially targeted at, but not restricted to, young adults and college students, that helps you to build healthy habits together with your friends. In the app, these healthy habits are represented by little challenges that the user can complete daily. These can be chosen and planned individually. Users set themselves a weekly goal and whenever a user completes a challenge like “Turn off your electrical devices 30 minutes before sleep,” they share a picture with their close friends, depicting their completion of the challenge. Coming up with a creative picture for the challenge is fun and makes the habit-building process less monotonous since

every picture is unique. Not only do you get to see your friends' healthy actions, there is also a way to keep track of your progress. Users can choose to build a mosaic together, an ever-growing collage of little challenge photos, to boost motivation and visualize their healthy journey.

"We decided to limit the communication between users to only one channel: Sharing photos. Our goal is not to create another application that people spend a lot of time on. After all, extensive social media usage is a common undesirable habit," says App developer Moritz Friedemann. With the absence of a chat feature, push notifications or a discovery page, the time that can be spent on the app is limited. Once users have posted their healthy picture and have seen the ones of their friends, they´re done and can carry on with their day feeling healthy and accomplished.

Paul now realizes it's time to head to his first lecture of the day. He grabs his water bottle on the way out and takes the stairs instead of the elevator for a change, smiles at the camera, ticking off his stairmaster challenge already. After all, "it is important to take small steps and make success visible in order to implement healthy habits in your daily life," says Michael Omann, the CEO of Movevo.



Research Report – Healthy Habits

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1. Introduction

Building lasting habits takes on average 66 days until they become integrated into people's lives (Clear, 2020). Although New Year resolutions are a motivating factor in integrating various types of health-promoting habits into people's daily routines, keeping them long term can be very hard. Oftentimes, this happens due to a lack of motivation in working on each behavior until it becomes automatic. Furthermore, in contrast to most negative habits, most healthy habits will only be rewarded much later. An example of this could be working behavior: procrastinating will give the immediate reward of avoiding stress and effort. The good habit of accomplishing things immediately might however only be rewarded hours, weeks or even months later, depending on the respective work. (Rutledge, 2021)

When trying to establish healthy habits, people are faced with a lot of distractions such as jobs or social obligations. But social media has a tremendous impact on people's lives as well: In Germany alone, people spend on average 101 minutes, or more than 1.5 hours, on social media per day (Harms, 2024). When considering this significant amount of time, the following questions arise: What makes social media so addictive? and Can the interactive tools of social media be used for something good? This is where our project "Healthy Habits" comes in, as this analyzes the potential positive influence of photo sharing on the development of healthy habits among young adults.

In section 2 of this paper, we will therefore start by defining the term "healthy habits," followed by a review of previous studies that showed a positive effect of social media on eating behaviors by utilizing social media features. This includes the possibility of supporting each other as part of a larger community and being able to demonstrate a certain behavior (Hsu et al., 2018). Keeping these results in mind, we will investigate whether such effects can also be used to enhance habit formation. On the other hand, a lot of criticism exists regarding social media, as it has been shown to have negative effects on mental health among teenagers and young adults. Thus, although we are aiming to use the effects of social media, this

should not lead to users spending a large amount of time on an app or starting to compare each other with strangers, e.g. influencers, as this can have more negative than positive consequences (Braghieri et al., 2022, p.3689). Our central focus lies in investigating whether social media can be used in a certain way which can promote positive behavior changes and healthy habits formation.

1.1. Thesis Objective

Our main objective is to analyze whether social media, or more specifically the sharing of pictures with friends, can be utilized to motivate users in performing regular activities meant to build healthy habits. We want to overcome the problem of people losing motivation in changing long-term behavior patterns by finding alternative ways to receive small immediate rewards in terms of sharing their activities with friends.

The question that shall be answered in our analysis is to what extent taking photos and sharing them with friends can increase the frequency of performing healthy tasks and the likelihood of building a habit. We do this by conducting interviews with experts in the field, using surveys as part of a market research and in-app questionnaires to get an insight into people's behavior.

1.2. Target Audience

Our target group are young adults aged 18-34, mostly consisting of, but not restricted to, university students. Apart from surveys and interviews, part of the data collection happens through an app which can be downloaded and used by anyone owning a smartphone. In our research we will mainly focus on the data from university students in order to have more easily comparable results, as students within a similar age group tend to have a more similar daily structure and social media behavior. To ensure the separation of these subgroups, users will be asked upon registration to indicate whether they are a student or not. The same question will also be asked as part of the market research surveys and interviews in order to be able to link the data later on. The exact content of the survey as well as the interviews will be explained in detail in section 3.

2. Literature Review

In the following subsections we will give a background into previous research that forms a basis for our research. To understand the potential impact of social media on the formation of habits, we mainly clustered our literature review into previous applications of social media in the context of health on the one hand and experience with apps created to facilitate the formation of habits on the other.

A habit is defined as an act or behavior done regularly, usually without consciously having to think about it or remember it.[11] In the context of our research, the term “healthy habits” can be seen as a broad term surrounding habits in various categories. This includes both physical health, such as exercise and nutrition, and mental health.

2.1. Social Media Tools in a Health-Related Context

Within the area of habit formation and behavior change, diverse strategies have been explored to encourage positive behaviors among people. Smartphone apps have emerged as tools that support habit formation through event-based cues and implementation intentions (Stawarz, 2015). Within a broader economic context, the concept of working habits within a neoclassical growth model was introduced, revealing their impact on labor supply (Faria, 2004). An investigation in 2010 identified key factors influencing information technology (IT) habits, including prior IT use, satisfaction, and perceived importance (Lankton et al., 2010).

Delving into the role of habits in post-adoption switching of personal information technologies, a study in 2011 explored its influence on both intention and actual behavior. This research emphasized the significant role of online social network dependency in habit formation (Thadani, 2011). Simultaneously, the dual impact of social media on health behaviors was highlighted, acting as both an obstacle and a motivator (Vaterlaus, 2015). In examining social networking sites, a study in 2019 distinguished between habit and addiction, emphasizing the positive influence of habit on goal-congruent outcomes and the negative impact of addiction.

1 see https://dictionary.cambridge.org/dictionary/english/habit#google_vignette

Current research suggests that a comprehensive approach is vital for fostering positive behavior changes and cultivating healthy habits. This approach involves integrating various strategies, such as context-dependent repetition, intention-setting, and the reinforcement of self-efficacy. This perspective aligns with findings from Thadani (2011), Vaterlaus (2015), Seo (2019), and Liu (2011). While technology, including smartphone apps and online social networks, holds potential for shaping and reinforcing habits, it is crucial to exercise mindfulness to avoid the potential of challenges related to addiction, ensuring a balanced and mindful usage (Stawarz, 2015; Thadani, 2011).

2.2. The Role of Apps in Habit Formation

Existing research indicates that effective habit formation apps should prioritize event-based cues and the reinforcement of implementation intentions, rather than relying solely on reminders and self-tracking (Stawarz, 2015; Wicaksono, 2019). However, it's important to note that these apps might inadvertently foster a dependency on continuous usage, potentially hindering the establishment of long-term habits (Renfree, 2016). In response to this concern, an alternative learning-based approach has been proposed, emphasizing the guidance of users through small daily changes (Vainio, 2014). This approach offers the potential for users to cultivate sustainable habits without developing excessive reliance on the app.

Research within the field of behavioral change suggests that integrating small daily challenges can effectively drive positive behavior changes and contribute to the development of healthy habits. Strategies proposed to initiate new behaviors, support context-dependent repetition, and facilitate automaticity, as recognized in previous work (Lally, 2013), have proven valuable in the establishment of new habits. Moreover, the role of short-term incentives in developing habits in children indicates that behavioral changes may persist even after the removal of incentives, as highlighted by Loewenstein's findings (2016). In the context of IT habits and habit formation, the significance of adherence, particularly within the realm of e-health interventions, is emphasized (Karppinen, 2018). A comprehensive approach shows the importance of simultaneously breaking existing unhealthy habits while promoting and establishing healthy ones for sustained and beneficial long-term results (Wood, 2016).

User satisfaction, habit persistence, perceived usefulness, and the intention to continue usage are key influencers of the sustained use of habit formation apps (Hsiao, 2016). Moreover, a proposed framework for designing apps that support lasting behavioral changes underscores key elements, including personalization, easy data recording, interactive reviewing, and subtle interventions (Stroulia, 2013). Some examples of subtle interventions within this framework include personalized reminders based on individual habits, gentle nudges to encourage positive behaviors, or prompts for self-reflection. These subtle strategies aim to influence user behavior without causing disruption, fostering a more seamless integration of the app into daily routines.

3. Methodology

3.1. Market Research, Surveys

To gain deeper insights into the needs of our target group, we set up a survey consisting of six items asking about (1) the willingness to build new habits, (2) the willingness to use an app for habit formation, (3) the willingness to specifically use a photo-sharing app for the purpose, (4) whether the participant sees social engagement as helpful in establishing new habits and (5) which features of an app would enhance habit formation. Furthermore, the participants had the option to give additional information on age, occupation and gender, to help us get a clearer vision of our target group. The survey was conducted via Google Sheets and promoted via mouth to mouth, the project´s instagram page (@behealthy_tum), the TUMJA alumni mailing list, the StudiNews newsletter and via the TUMJA network in general.

3.2. Expert Interviews

To gain a deeper understanding of habit formation and especially habit formation in the context of an app, we set up interviews with experts from the field of behavioral psychology and health science, focusing on experts whose research focuses on habit formation. The interview questions specifically ask about tips to improve the habit building process and how to support people through it, the experts' experience with digital tools in habit formation, and possible challenges that arise when using digital solutions.

3.3. Development of the "BeHealthy" App

To examine our hypothesis and explore the impact of social media mechanisms on habit formation, we developed a smartphone ap-

plication designed precisely for this objective. To achieve it, the app needed to serve as a platform offering two primary functions: the ability to choose and complete regular challenges, and the possibility of sharing photos with friends. Additionally, it needed to gather the relevant data for our subsequent analysis. We called the app "BeHealthy" to reference the goal of the app for its users. In the following paragraphs, we describe the development of the app and the thoughts that went into design decisions regarding its features.

3.3.1. Challenge Mechanism

According to findings from our literature review, which strongly indicate that habit development relies on personally selected objectives (Gardner et al., 2014), BeHealthy users have the autonomy to select challenges and determine the frequency of their completion per week (referred to as "weekly goals") on their own.

They can choose from a set of 21 predefined challenges clustered into the following three categories:

1. Nutrition: This comprises challenges surrounding healthier, regional and more sustainable nutrition, for example, to eat only plant-based foods for one day.
2. Be active: This includes both activities of daily life, such as taking the bike instead of the car on the way to work, but also active exercises, such as going for a run. The exact scope of the challenge should be defined by the user depending on their fitness level.
3. Sleep & Mindfulness: This refers to any challenges related to mental health, sleep, structure, etc., e.g. writing down 3 things you are grateful for today.

To reduce the initial resistance people might have, the challenges are designed to be quickly and easily achievable throughout the day. Additionally, users are prompted not only to choose challenges but also to determine a weekly completion goal, allowing them to schedule when to undertake the challenges throughout the week. This goal can be modified according to the user's schedule and experience with the challenge. Furthermore, the progress for all challenges is reset every Monday at midnight in order to define a weekly rhythm for all users.

Upon completing a challenge, users can mark it as done within the app, advancing the progress bar by one step and opening the camera feature. While users have the option to skip this step if they prefer not to take a photo, they are encouraged to either capture a picture or upload one from their camera roll, which will then be shared with their friends on the app.

3.3.2. Social Aspect and Incentivization

While BeHealthy is a social medium in so far as it connects people interested in building healthy habits, we limited the communication through the app to only sharing photos. There is no chat feature or other communication channels in order to avoid giving an incentive to spend large amounts of time in the app. In their feed, users can see the photos of healthy challenges that their friends completed. These posts disappear after 24 hours.

BeHealthy allows users to collect their photos in "mosaics", on which they work together with friends or colleagues. A mosaic is a grid that users can fill step by step with their challenge-related photos. The idea behind this is to allow users to look back on their habit building journey and appreciate how far they have come, which is an important factor of motivation. Expanding the mosaic together further increases motivation of all contributing users. To avoid incentivizing users to spend a lot of time with the mosaics, it is not possible to rearrange the photos and their position can't be chosen either. The latest photos are always in the center to focus on the present accomplishments.

Other social media apps often use gamification to make their users spend more time in the application. Earning points, climbing up ranks or keeping a winning streak alive are all examples of strong incentives based on gamification (Sarbadhikari & Sood, 2018).

Since these features impact the user's motivation, they could be confounding variables when analyzing the effect of sharing photos. In order to isolate the effect and to avoid behaviors like posting a blank photo just to keep a winning streak alive, we decided to reduce the extent of these features to a minimum. With the same goal of isolating the effect of sharing pictures, we decided against sending users reminders to work on their challenges, even though this might further increase motivation.

3.3.3. Implementation

The app was programmed using the React Native Framework.[2] This JavaScript-based programming framework allowed us to develop an app for both IOS and Android simultaneously. By using this method, we were able to reach a larger target group without significantly increasing the development effort.

To further facilitate the development process, we used the open-source framework Expo,[3] which provides various tools for creating a development environment, building the App executable and submitting it to the App Store and Google Play Store.

Given the diverse data our app manages, including user accounts, challenges, and photos, a robust database connection is essential. To uphold user privacy and avoid reliance on servers hosted by tech companies like Google or Amazon, we integrate PocketBase,[4] an open-source backend service and open-source alternative to Google's Firebase. PocketBase provides a database structure compatible with React Native and includes features such as secure user authentication via passwords and usernames. Moreover, it grants us the flexibility to host the database on a server of our choice. To ensure responsible and secure data management, all data is stored on a server at the Leibniz-Rechenzentrum (LRZ) in Munich.

3.3.4. Data Collection in the App and Key Metrics

The BeHealthy app gathers various types of data throughout its usage.

Upon initial registration, users are prompted to complete a one-time initial survey aimed at establishing a baseline of their current habits and behavioral patterns. Additionally, ongoing follow-up surveys are conducted weekly throughout the study to monitor the progression of habit formation over time, utilizing the SRBAI (Self-reported-behavioral automaticity index), a tool endorsed by the American Psychological Association and widely employed in numerous studies.

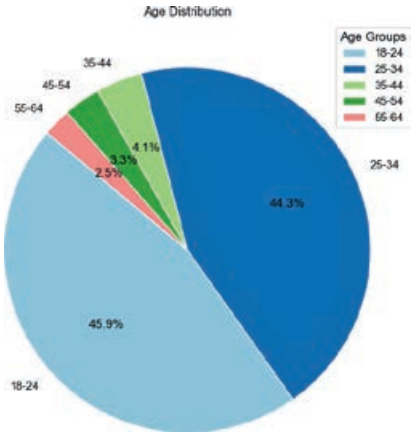
Furthermore, in addition to survey responses, the correlation between achieving challenge goals and the frequency of photo uploads is monitored to investigate the hypothesis that sharing photos can positively influence habit formation.

Lastly, a demographic correlation analysis is conducted to explore potential associations between age, gender, and the observable effectiveness of habit formation.

4. Results and Discussion

The purpose of this analysis is to explore the tendencies of the target population regarding their openness to trying an app aimed at promoting healthy habits. The data was collected through a survey openly shared and filled out online by 122 participants.

The survey included participants from all age groups, as illustrated in the following pie chart. The majority of respondents were distributed across two primary age brackets: 18-24 years, constituting 45.9% of the sample, and 25-34 years, accounting for 44.3% of the participants.



2 see https://reactnative.dev/
3 see https://expo.dev/
4 see https://pocketbase.io/

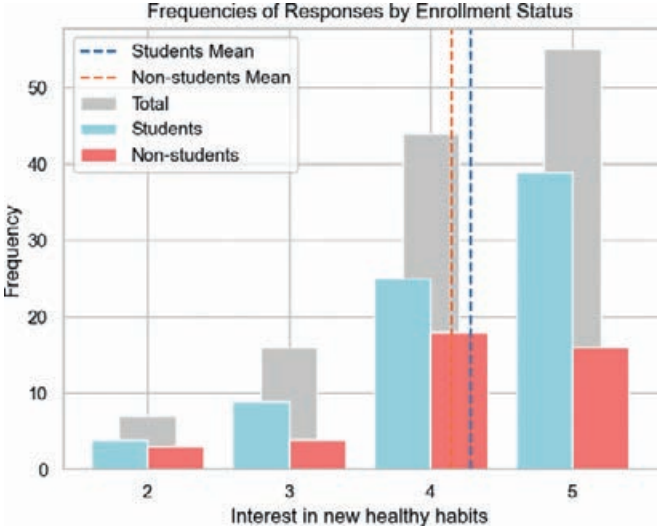
Consequently, the age distribution corresponds with the expected target group. Additionally, more than 65.3% of the participants are currently enrolled in a study program.

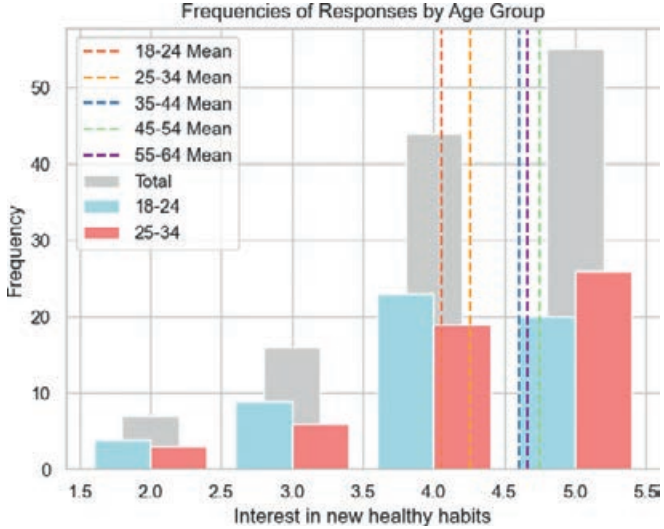
The survey experienced greater participation from the female demographic, with approximately 55.7% of respondents identifying as such.

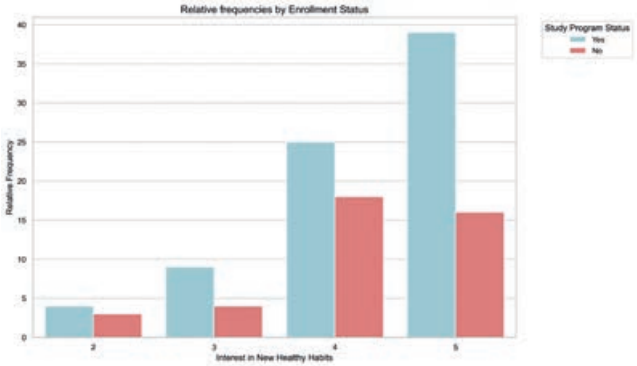
As the target population is represented by young students, the following analysis will use the enrollment status and age group as a term of comparison with age being clustered into the following three groups: 18-24, 25-34, and 35 and older.

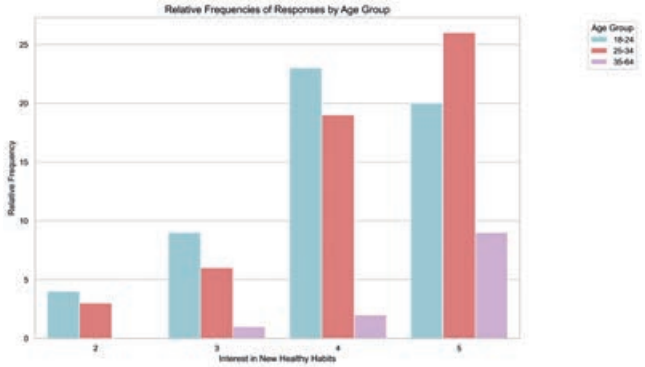
4.1. Interest in healthy habits formation

Regarding the general interest in the formation of healthy habits, the responses show a large interest across the largest proportion of participants: on a scale of 1 to 5, 81.5% selected 4 or 5 for the question as to how much they would like to implement healthy habits into their routine. Greater interest in new habits formation was expressed by students compared to non-student participants. Interestingly, participants aged 25 and older expressed a higher interest in habit formation than young adults.







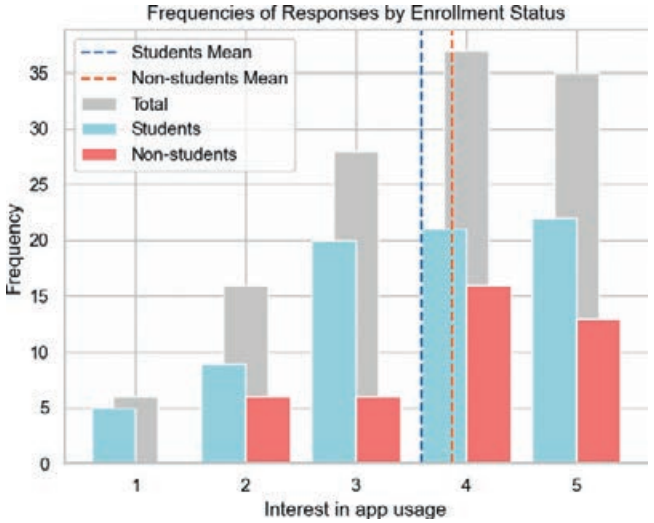


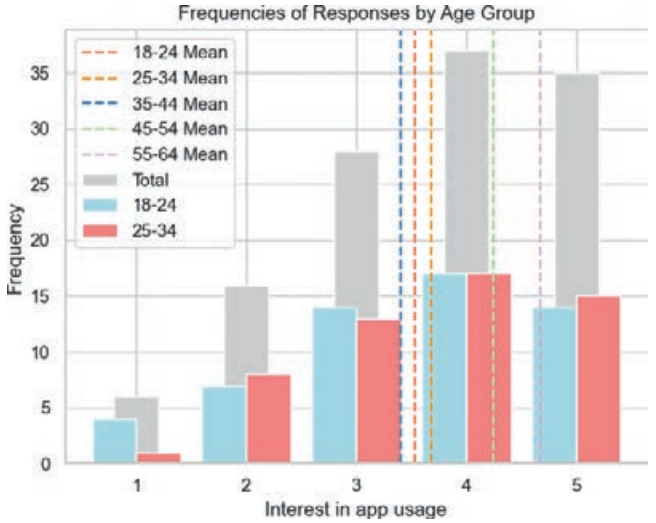
4.2. Using an app for building new healthy habits

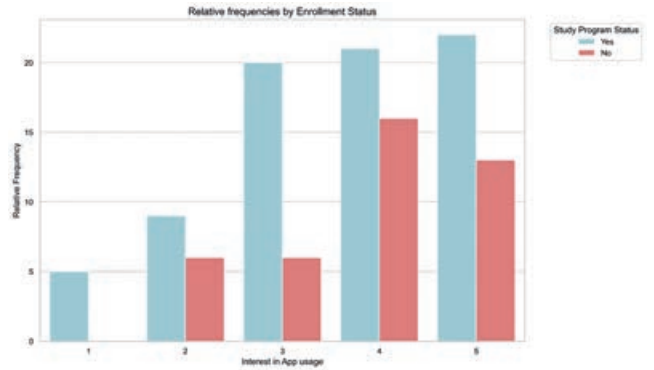
The second question explored participants' willingness to use a mobile application for forming new habits. While the results are not as straightforward as in the first question, 59.6% of participants either agreed or strongly agreed with using an app (30.33% chose “4”, 28.69% chose “5”). This suggests an openness to utilizing technology as a tool for cultivating healthy habits, with however a considerable percentage expressing uncertainty or reluctance.

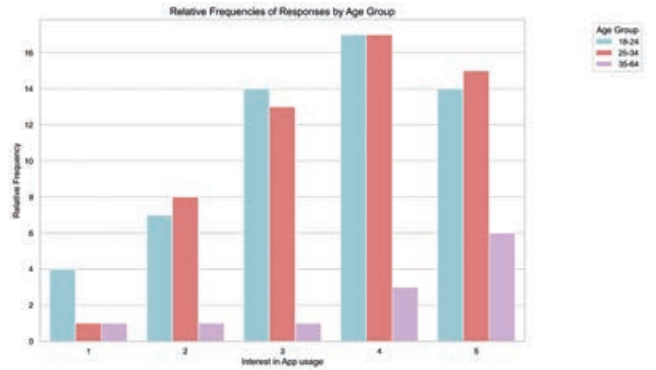
Non-students show a slightly higher inclination toward app usage compared to students, with minor differences across age groups. Furthermore, higher age groups tend to show a slightly higher interest in utilizing an app than participants from the younger groups. Nevertheless, both students and the 18-24 age group still express a strong openness to adopting an app for habit-building.

The results emphasize the variation in willingness to adopt an app-based approach, influenced by age and student status. It is important to analyze results both within and between different groups. This approach of differentiating between both student status and age group allows for a comprehensive understanding of the varied perspectives and trends existing within each group and facilitates a







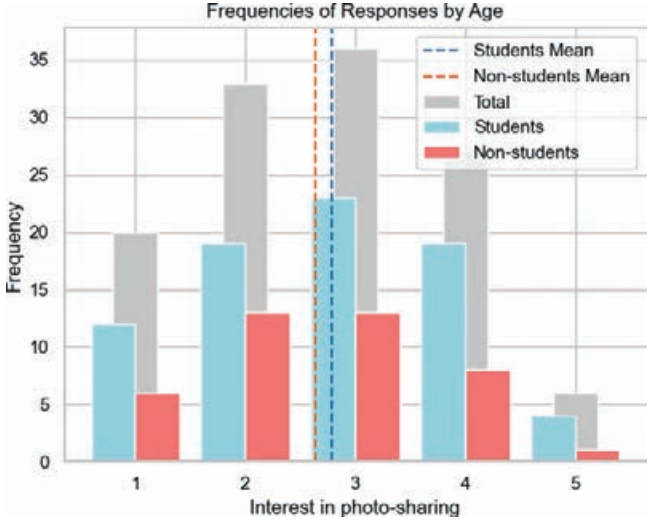


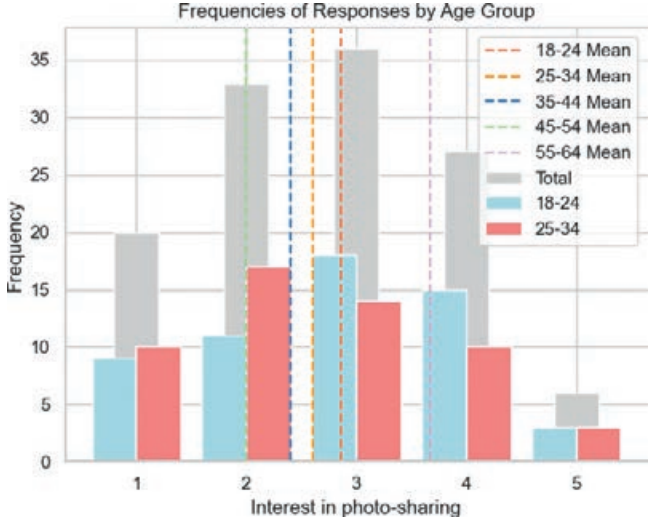
comparison of how different demographic segments respond to the questions. Moreover, the observed variation in responses, whether examining between or within age groups and student status, may result from differences in the age distribution of participants, particularly with a substantial number falling between 18 to 24 and 25 to 34, contributing to increased diversity in opinions.

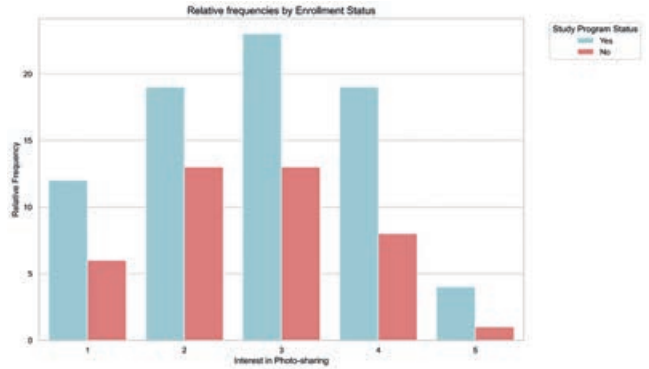
4.3. Photo-sharing app

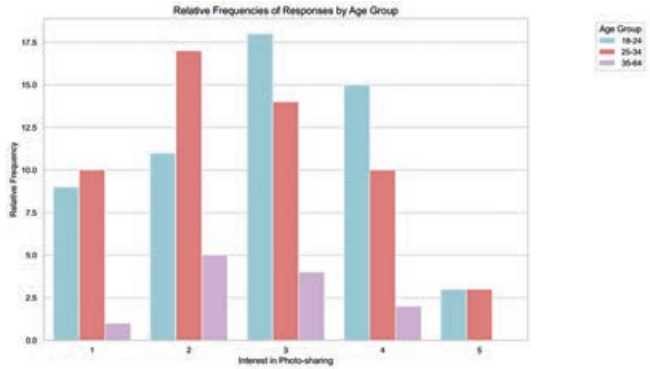
The third question asked participants whether they believe a photo-sharing app could be helpful in developing healthy habits. About 30.6% of respondents believed it could be somewhat useful (score 3). 27.05% expressed reservations (score 2). The distribution indicates a varied view on the potential effectiveness of photo-sharing apps, with the majority falling in the middle of the scale.

Participants' perceptions of a photo-sharing app as a tool for building healthy habits revealed interesting trends. In the 18-24 age group, both students and non-students saw potential in a photo-sharing app, with non-students leaning towards higher ratings. The 25-34 age group, especially non-students, expressed a favorable view of the app's usage, while students showed a more diverse response.









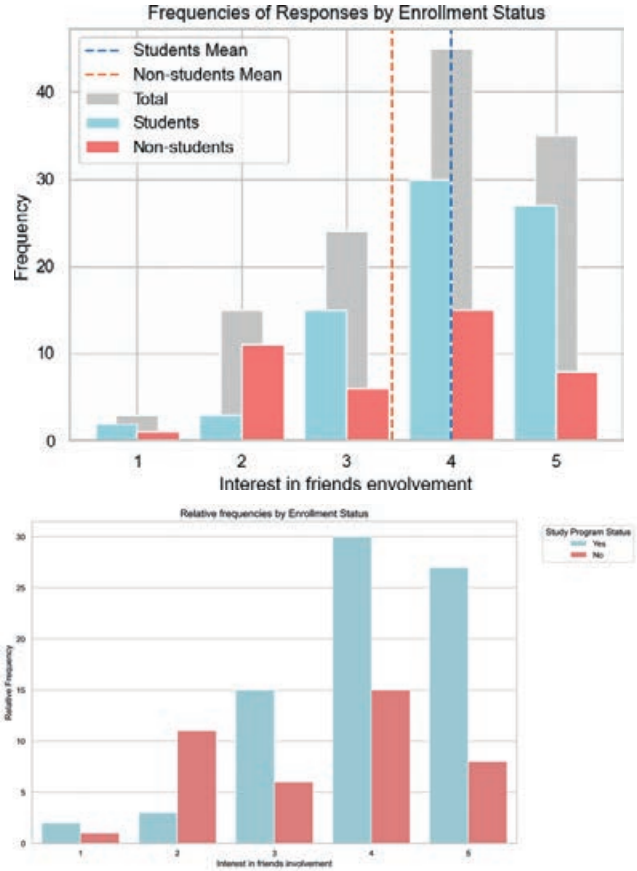
4.4. Friends' involvement

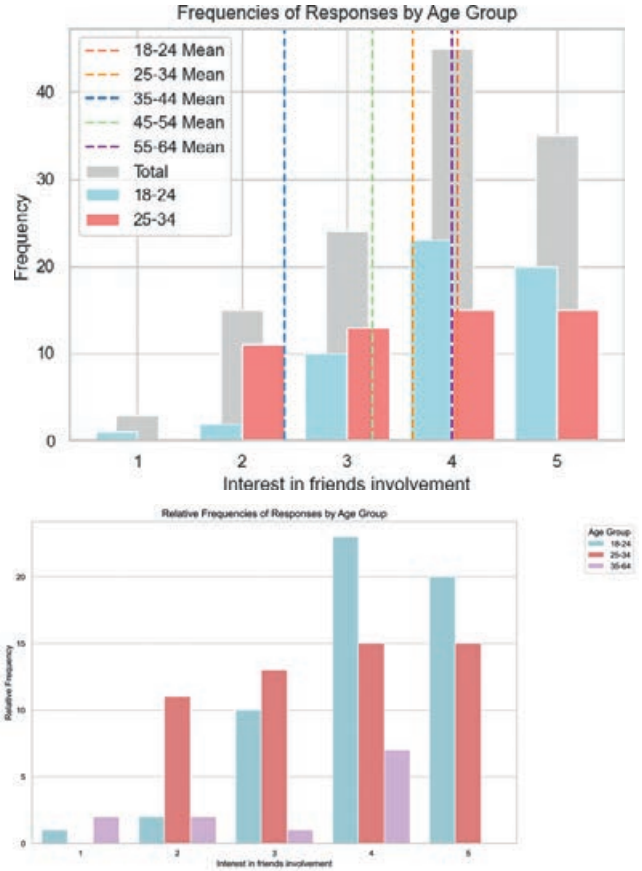
37.1% of participants believed involving friends in one's health routine positively impacts their ability to establish and maintain healthy habits (score 4), and 28.69% expressed an even stronger agreement (score 5). This suggests a recognition of the motivational and supportive role that friends can play in fostering healthier lifestyles.

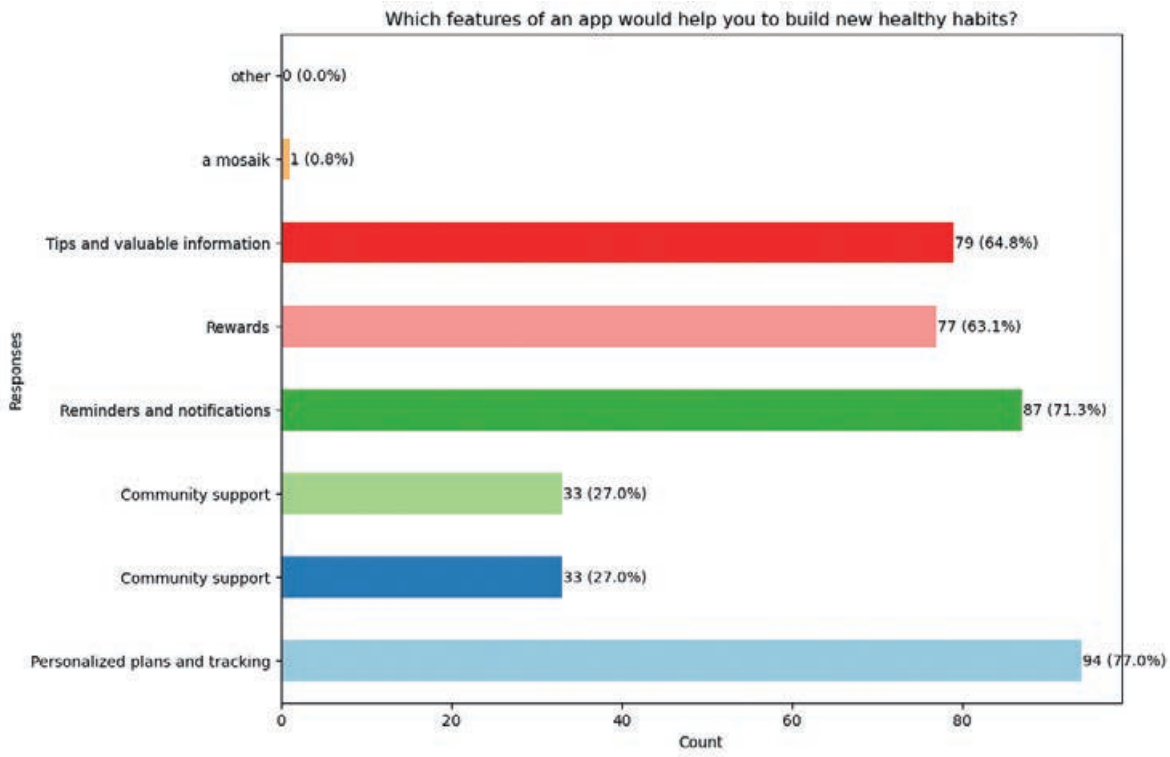
Participants aged 18-24 and 25-34 expressed a relatively positive view, with a significant percentage favoring ratings 3 and 4. Upon delving into the distribution of responses between enrolled students and non-students, it becomes evident that students generally show a higher level of agreement. Conversely, when we break down the responses by age group, it can be observed that younger students tend to have a lower average agreement. However, this could be attributed to the larger number of responses from this age group, potentially leading to greater variance compared to older participants.

4.5. Relevant features

In the graph below, it's clear that individuals prioritize certain features for fostering new healthy habits. Personalized plans and tracking hold the highest importance, with 77.0% agreement, followed by reminders and notifications at 71.3%, and tips and valuable information at 64.8%. Understanding these preferences is crucial for adding future features to the app.







4.6. Expert Feedback

A total number of three experts on habit formation were interviewed and their findings and feedback will be summarized in this section. Those experts were Bastian Schmidtbleicher of MOOVE GmbH, Christian Hoffmann of lebensfreude gesundheitsmanagement and Michael Omann, founder of MOVEVO. They were interviewed regarding four main questions:

1. What mechanisms/incentives can be helpful regarding habit formation in general?
2. Do you have experience with digital solutions in the area of habit formation (or if not, why and do you believe a digital approach can be helpful)?
3. Do you know of similar projects or approaches like ours? If so, what were challenges for you and what worked well?
4. After a demonstration of the app: what can be improved, especially regarding the habit building process?

4.6.1 Positive Feedback

Our interview partners liked the idea of photos to visualize the results, giving users the possibility to look back on their healthy journey. This reflection and reminder of the effort one has already put into forming the habit is beneficial to maintaining one's motivation. The design of the challenges also received positive feedback. They represent small tasks which are easy to implement, which is essential for the habit formation process. The user's resistance to taking a step towards their goal must be kept as small as possible and there must be intermediate goals like completing a ring of photos in one's mosaic in our app.

4.6.2 Suggestions

In order to answer our research question about sharing photos, we needed to isolate their effect. One strong confounding variable we decided to eliminate are notifications which remind the user of

completing their challenge, which would have a significant effect on motivation. From our interview partners, we got the feedback that these reminders are very beneficial for the success of the individual habit formation process. Another suggestion was to let the user define their personal goal and motivation in the beginning and to frequently remind them of it visually. Additionally, we were advised to further motivate users to complete challenges together to connect their habit to social contact.

5. Conclusion

To conclude, our findings show that there is an interest in an app that helps users to integrate new healthy habits easily into their daily routine. Furthermore, a substantial number of surveyed people consider that involving friends in their habit building process can enhance habit formation, which is especially interesting for us with the background of challenge mechanism and app design.

Even though the time the project required exceeded our expectations and plans, good things have come from it. Apart from being a learning experience for all team members, the questions and design decisions we discussed in the context of the app are important for the future of social media, particularly for designing these in a benevolent and healthy way.

Instead of simply talking about a potential healthy social media, we made it easy for users to provide valuable concrete feedback by proposing a concrete application with all the design decisions made by us. This feedback and the lessons learned in the process, may be the biggest positive result of the project. The team is highly motivated to continue the research with the vision of a social media that helps people build healthy habits in the near future.

Once the app has been running with a substantial number of users, we are aiming to collect data from the app and conduct interviews with users as described above for our future research. This research will be used to get not only qualitative, but also quantitative data on actual users in order to better understand the effects of social media and photo sharing on habit formation.

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Self-reflection

“You’re making a mistake.“ When we, Team Healthy Habits, presented our idea to develop an app to help people build habits, not one, not two, but most of the TUMJA’s trainer team advised us to rethink our decision. Past project teams had already tried it and had to face major difficulties or reduce their scope later in the project. We took this feedback very seriously and decided to pursue our idea nonetheless. We wanted to actively help people, not only analyze and ponder what a good approach would look like. While, as time would tell, the warning proved to be valid, we are still very glad that we made this decision. All of us have learned a lot about teamwork, habit building, marketing, questioning one’s whole project, and setting deadlines to get things done (as strongly encouraged by the trainers). Every team member can look back on the project and say, “I contributed something meaningful to this project,” and in our 20 months of being scholarship holders, we created something tangible that could help people.

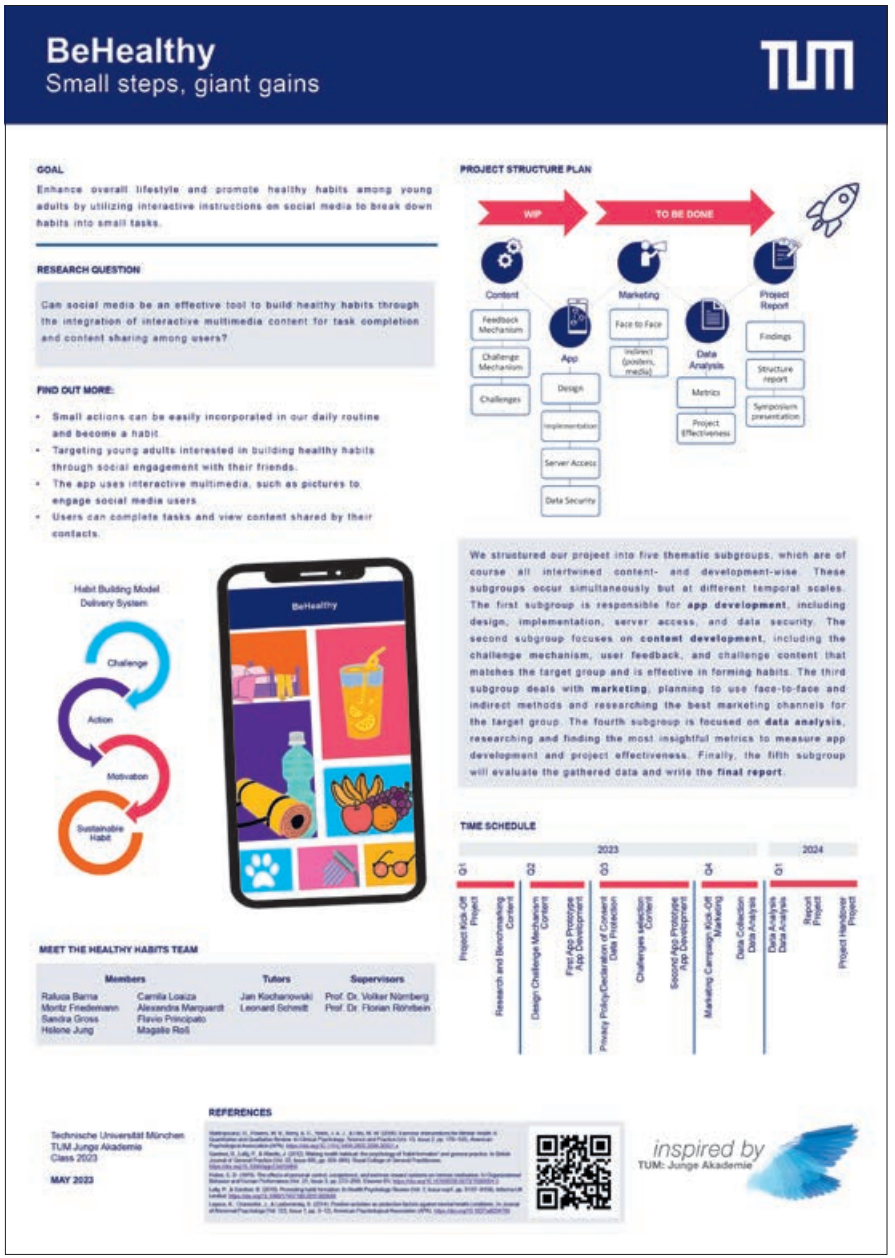
One of the biggest strengths of our team was the good mood and spirit since the beginning. After the kickoff weekend, the team consisted of only four members and in the following weeks it doubled in size. Even though those new team members hadn’t been there since the very start, they were integrated well and didn’t feel left out. In the beginning of the 20 months period, we came up with some traditions that we kept up until the end. One example has to do with the hybrid nature of our team meetings. Between exchange semesters, internships, and other obligations, there was no point in the 20 months when every member was in the same place. That’s why we did our weekly meetings in a hybrid format. All those who could make it in person, met at the TUMJA office and also joined a zoom meeting with those who were abroad. Organizing these meetings wasn’t always easy, since at one point, we had to unite Canadian, European and South-East Asian time zones.

At the end of every meeting, we took a meeting photo (there are over 30 of them). It feels good to look back on the progress of the project and the changes all the team members went through during their time at TUMJA. To give a glimpse, we decided to put a mosaic of these meeting photos in this report. It is in the spirit of our project, as the app enables every user to do the same, build a mosaic of their habit-building progress, and look back on what they have accomplished and how they might have changed in the process. We also measured (more or less scientifically by the angle of the members’ thumbs up) how the mood and productivity were in each meeting. The resulting graph of mood and productivity scores was quite interesting, too, as it clearly displays phases of lower productivity that the team experienced. These phases are part of every big project and are often related to longer distances between teammates or problems faced in the project. In our case, they led to a significantly delayed launch of the BeHealthy app, especially since we underestimated some of the difficulties in developing a whole app from scratch. Among many others, many bugs would surface during user tests, and we had to let users try BeHealthy as beta testers because we couldn’t get an independent ethics committee’s appraisal in time to make the app available in all stores.

As we have put so much thought, passion, and resources into the project, it stings a little bit to end it in a somewhat unfinished state, with marketing measures waiting to be employed and the potential to help people. That’s why a group of team members is still convinced by the idea and motivated to keep the project going after the time at TUMJA. So stay tuned for what’s to come…

Your Team Healthy Habits

Acknowledgments
This project would not have come nearly as far as it has without our wonderful tutors. Leonard and Jan not only brought a fun and familiar vibe into the team but contributed many good ideas. They also attended most weekly team meetings and weekend seminars. Throughout the project they felt more like two additional team mates than like external tutors. We want to thank our supervisors for their feedback and the valuable contacts we have made through them. We're especially grateful to Prof. Nürnberg for inviting us to the Top Arbeitgeber Kongress TAK in Mainz, where we got to see him and Dirk Nowitzki speak and meet experts in corporate health management like Christian Hoffmann to interview about our project. Big thanks to everyone who tried out and used our app. The concrete feedback was very useful in fixing many little mistakes and evaluating whether this app actually helps people. Last but not least, this kind of project is made possible by TUMJA and their unique positive ambiance that motivates a whole team to do a project together for 20 months. During the seminars and office discussions, we learned a lot from the inspired people that TUMJA brings together. We're proud to be a part of it.



POSTER 1:

Our project started out with the aim of finding effective ways to integrate healthy habits into our daily routine. We thought of small challenges that should be fun to do and give people concrete tasks for the day which are rather easy to solve and can actively be ticked off once completed. During our literature research we found many papers and books that all agree on small steps being imperative for habit formation. Yet, we realized that while there are so many initiatives on how to build healthy habits one step at a time, most people fail to keep working on them before these behaviors even become habits. So, we thought: what tools are already in people's everyday life that we could utilize to support habit formation. The first thing that came to our minds was social media. And while we found that social media can have both a motivating and an addictive factor, we also found that it has already shown itself to be helpful in other contexts such as eating disorders. Using this knowledge, we finally decided to utilize the positive aspects of social media to motivate people in their habit-building journey and to incorporate a social factor by building an app.

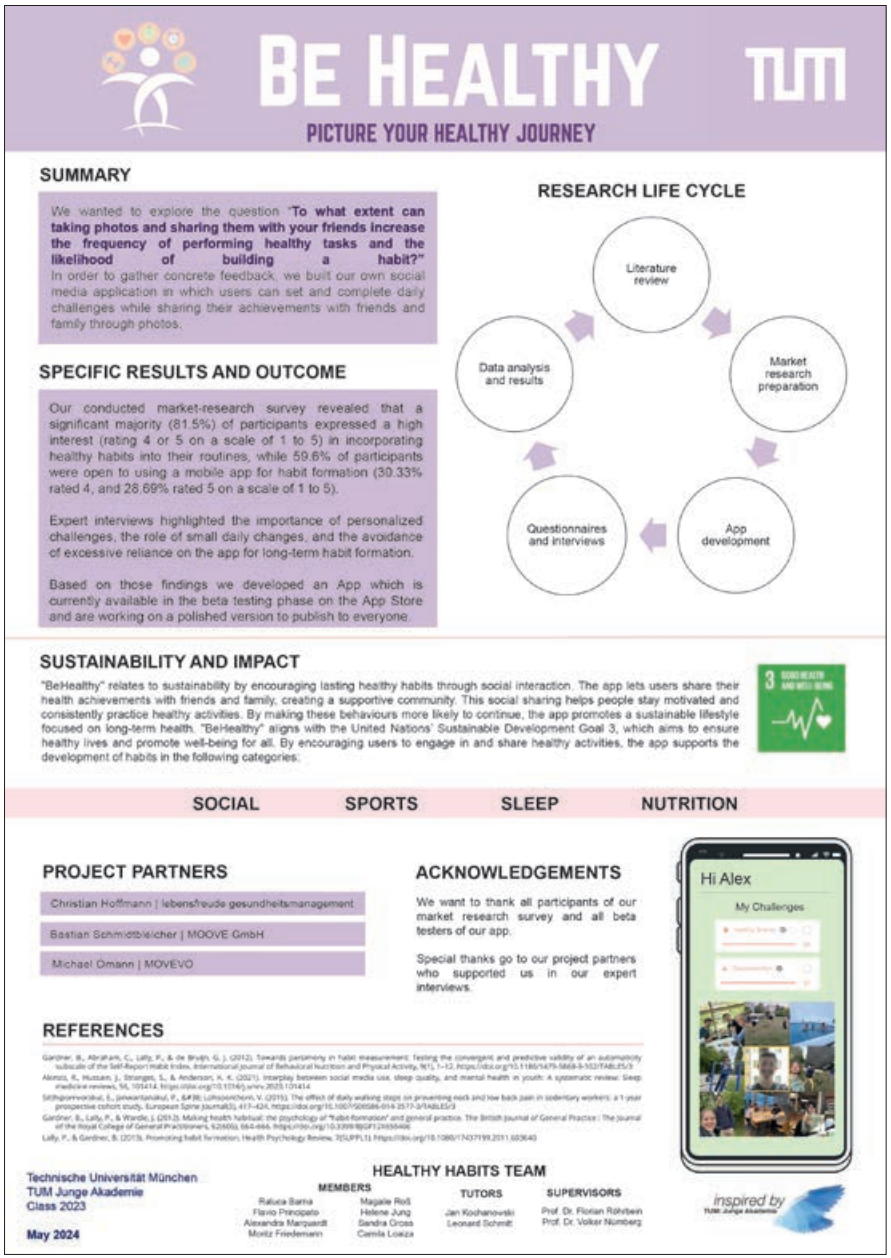
During the following months, we split our group into the following three subgroups to work on the project: App development, Content/Challenge Mechanism and Marketing.

POSTER 2:

To answer our question to what extent sharing photos of performing healthy tasks can increase the frequency of performing these tasks and the likelihood of building a habit, we incorporated several scientific methods. The basis for our research lay within the app itself since we did not build it only in response to our initial research, but also as a tool for collecting the necessary data for our main research later. While continuously collecting data on challenge completion and pictures shared, we planned also to integrate bi-weekly surveys in the app. The purpose of the app usage data is to set these in relation as part of a regression in order to get an understanding of whether users who utilize the social media aspect of the app more often also tend to perform better. Since this, however, only indicates the frequencies of use and no conclusions on habit formation can be drawn, the survey - which includes questions from the SRBAI ("Self reported behavioral automaticity index") by the APA – has the goal of showing progress on the habit formation. Finally, to supplement our data, we decided also to conduct interviews with app users to add a qualitative approach in terms of self-reflection.

POSTER 3:

While our development team was working on programming the app, they were in close contact with the content team. The latter came up with the process on how users should be guided through the app, at which stages surveys should be introduced and how the challenge mechanism should be set up, including the respective challenges for each of the three categories: Nutrition, Activity, and Sleep & Mindfulness. Meanwhile, the marketing team prepared the app launch by presenting the project at student fairs, designing flyers, posters and branded pens and creating an instagram account to increase visibility. On top of the bi-weekly surveys, we also decided to include an initial survey to assess the initial state of our users lifestyle which may be repeated at a later stage to make a comparative analysis between the “before” and “after” state. The survey included questions such as their average daily sleeping time, their preferred way of commuting, their primary diet, etc.



POSTER 4:

Because of delays in the app launch (for which there were many reasons), we had to find alternative ways for our initial data collection in the final stage of our project. We decided to conduct market research surveys with potential app users to get early feedback and ideas on what aspects might help users build healthy habits. The participants of the survey ranged across all age groups, though with a large proportion of students since these are also the target group for the final app. Furthermore, we held interviews with experts in the field of health and habit formation, including Christian Hoffmann (Health Manager Lebensfreude), Michael Omann (CEO Movevo), and Bastian Schmidtbleicher (Manager Moove). With their help we gained deeper insights into our topic and received valuable feedback for the app to help us further improve it.

Our app "BeHealthy" is currently available in the Beta version on the app store where we are currently testing it with a rather small number of users before it is officially launched. Moving forward, we would like to continue our research through the utilization of the app to add onto our existing findings with more quantitative data.