Fitness wearable features that motivate students for long-term use

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***Abstract*—Wearable fitness tracking technology has made a lot of progress the past two decades. The technology serves an important role in the daily life for a lot of people, but a problem many people face is that they lose motivation over time, and stop using their wearables. In this paper we aim to identify which features and characteristics that contribute to a student's motivation for long-term physical activity the most. We have chosen a case study as the research strategy, focusing specifically on the student demographic. By employing focus groups for generating data, we were able to acquire a broad range of opinions and valuable analysis. Fitness tracking was the main reason why each of our participants started using their wearables. Most of the participants also routinely used the health metric tracking aspects of their wearables. There was generally strong agreement that the data tracking and analysis were the most motivational features in their trackers. They enjoyed using the tracker as a workout diary, and being able to keep track of progression. Several participants connected their wearables to Strava, a social media platform centered around working out.**

***Index Terms*—Fitness wearables, activity tracking, motivation, m-health**

I. Introduction

Tech-industry analyst CCS Insight estimate the wearable market to sell 54 million fitness trackers by 2021 [1]. In the last few years, wearable technology has ignited people to track personal information related to health- and fitness-activities. Devices like smart watches and phone applications track data like pulse, steps and sleep quality, in order to improve the users self-care awareness and physical activity. Active and sedentary lifestyles alike hold incentives for making use of this kind of technology. Already active people may see benefits to getting assistance in keeping track of their physical progress, while the inactive individual may derive an initial motivation for getting out the door and start being active. Research indicate that pedometers relate to significant increase in physical activity and significant decrease in body mass index, but it´s unclear if the changes are persistent over time [2]. Other studies have also highlighted that features like goal setting, monitoring/tracking and feedback is the best features for motivation [3]. However, it seems to be unclear which of the features has the greatest effect on motivation and how these features motivate over time.

A problem with wearable fitness tech is user retention. A lot of users will buy wearable tech, use it for a while and end up not being motivated enough for prolonged use. There already exists similar studies that addresses the main features of wearables users are most motivated by, but these papers look at adults in a wide age gap. There is a big difference in health, activity level and mindset between a student and an older person [6], that might affect the results. In this paper we have explored which features and characteristics in wearable fitness tech that users find compels them to continue use, and which features provide the strongest motivation for physical activity.

The paper's research question is defined as such:

Which features in wearable fitness trackers provide the highest incentive for long-term use among university students?

II. Background

In 2016, Alturki and Gay performed a systematic review of what features should be supported by wearables and fitness app to help users overcome obesity. They highlighted goal setting, monitoring/tracking and feedback as the best features for motivation [2]. A study from 2014 believes that long-term wears of wearable technology have needs and practices that are different from those in the initial weeks of use [4]. There is also studies showing that at least a third of the users quit using their fitness tracker after six months [5]. This is interesting since we want to increase the understanding of how wearable devices affect the user's motivation to engage in physical activity and health-promoting behaviours over time.

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Spillers and Asimakopoulos [7] has already tackled similar research questions, and gives some insight into whether or not social media features and gamification add value to m-health user experience. They found that "running apps designed to track a runner's activity can influence intrinsic motivation regardless of social or gamification elements" [7]. While many of the participants in their study enjoyed playing games in general, they did not like how gamification was implemented in the chosen apps. As such, a possible limitation with this study is that the chosen m-health applications had particularly poor implementations of gamification and social elements. Most of the apps only allowed users to connect to existing social networks like Facebook, and the Runno app was overly focused on gamification in a way that made it bothersome. M-health apps have come a long way since 2014, and as such

we can contribute by looking at how the users' attitudes have changed with more recent implementations.

Another study [8] tries to answer the question of which gamification elements in m-health apps are the most motivational. An interesting finding is that social elements in m-health applications was the least motivational gamification feature for the respondents. On the other hand, they were most motivated by the data analysis of their training sessions, and to track their progression. Extrinsic rewards such as badges, leaderboards and intensity scores were also important to the respondents. A possible limitation of this study is that they gathered the data from a questionnaire. This means that the respondents weren't required to supply any explanations as to why they gave a certain gamification element some score, which may be the reason why social elements are rated so poorly, because not many people use them. It could be that the few people who actually use the social features are highly motivated by them.

III. Methods

A. Research strategy

We decided to use case study as the research strategy, because of time restrictions making it necessary to focus only on students as a specific case of fitness tracker users. In order to find out which fitness tracker features that motivate students the most, their opinions have to be taken into account. These opinions can then be used to challenge, or exemplify, existing research done in the field of motivation design, like gamification, social aspects and competition [7].

Another research strategy that we considered using was a survey, because it would allow for more effective data generation methods, like distributing questionnaires on social media. This would probably require less effort and result in a larger quantity of respondants, but at the same time the quality of the data would be worse. The relations between human motivation and fitness tracker features are too complex to be adequately communicated through a set of multiple choice questions. Case studies on the other hand seek to obtain rich and detailed answers, usually by interviewing people.

B. Data generation and analysis

Focus groups were used as the method for generating data, because they are good for acquiring a broad range of opinions about a subject [9]. By putting together students who have previously used fitness trackers with current users there might be differing opinions, which could spark further discussion. Another reason why focus groups might be preferred rather than normal interviews is that there will be less overlap in common opinions [9]. A qualitative data analysis method was used, because the verbal data expresses opinions about which design elements are motivational, and these could be further abstracted into the categories identified in previous research papers as mentioned above. Table 1 shows how the results have been organized into categories.

C. Participants

The Covid-19 situation made it difficult to find a sufficient amount of students for both the cases of having stopped using a fitness wearable, and currently using it. We ended up conducting one focus group with four students at NTNU, each of whom had used a fitness wearable for at least two months, and one of them had previously changed a functional wearable out with a new one. The participants had a varied selection of wearable watches, representing Fitbit, Garmin and Polar. Fitbit and Garmin are the top two companies operating in the global wearable devices market [10]. The age of each participant ranged between 22 and 24 years, and the gender distribution consisted of 1 woman and 3 men. The focus group was conducted on campus at the university of NTNU in Trondheim, Norway.

IV. Findings

This section presents the relevant findings from the focus group interview. Table 1 provides a summary of the participants' quotes related to the different aspects of the wearables, while the rest of the section provides a more in-depth description of the findings.

Fitness tracking was the main and common reason why the participants started using their wearables. One of the participants stated that "I bought mine because I had been running, and generally been active, and I thought it would be fun to view my speed, altitude meters etc. on each run I take". In addition, all except one used their wearable to measure everyday activities like sleep tracking, step count, calorie count etc. The reason one person did not track these sort of data, was because of the dissatisfaction he felt by wearing anything around the wrist.

Since the common denominator for the usage of wearables in the interview group was fitness tracking, we asked which functionalities motivated them in relation to exercising. One of the first things that were brought up was that the wearable worked perfectly as a 'workout diary', to keep track of exercises and progression.

To get an extension of this diary, three out of four had connected their wearable to the social media workout application Strava. One of them mentioned that "when connecting my wearable to Strava, I feel 'pressured' to exercise, and generally get out on a run". Then the other participant added that he agreed, and that "I like to compare my own stamina between runs, and that is very easy to look up in the app". Another perk mentioned, by using Strava, was that "the wearable is automatically synced up with it. The social aspect is fun, because you can recieve and give your friends 'kudos' ". This was presented as more of a fun functionality, rather than a decisive factor for motivation.

In addition to the social media aspect, everyone agreed that basic functionalities like being able to create their own workouts, keeping track of time, pace, and heartbeat, during workouts was very helpful. These functionalities increased the workout experience, by providing a helpful overview, and a basis of comparison. It seemed clear that the workout data

TABLE I
USERS' QUOTES SUMMARY

Theme	User quotes
Tracking, analyzing data, progression	"It's great to see the average time along the way when I jog. It gives the opportunity to be able to adjust the speed. It gives a sense of control."
	"All the training activity data is stored in the app, like fastest run. Then you have it in the mind all the time and that is a motivating factor."
	"It works well as an exercise diary"
	"You would not have had any idea of your own progression if you could not see the statistics on the app, so it is motivating. To see progression on runs motivates me to want to take some extra rounds."
	"Something that motivates me in a workout is to see how high my heart rate is. I want the highest possible heart rate."
	"What I use most is time, length and average speed. In Strava I also like that you can match runs."
	"Something that motivates me in a workout is to see how high my heart rate is. I want the highest possible heart rate."
Strava(social)	"When connecting mywearable to Strava, I feel 'pressured' to exercise, and generallyget out on a run."
	"The social aspect is fun, because you can recieve and give your friends 'kudos'."
	"It is motivating to post on Strava, then I can show people when I have had a good progression I am happy with."
Notifications, nudging	"I testet notifications, but I only got disturbed by them"
	"I don´t have notifications on"
	"it has never happened that I havemoved, when this 'move'-notification has told me to move. I do not care for it "
Gamification, acheive goals	"I don't care on a regular basis, but right before I went to bedthe other day I had 90 steps left to reach my goal. Then Iwandered around in my apartment to reach this goal"
	"It's a circle that says how much you have left of today's goals etc, but I do not usually look at it. In some periods I may like it, and for example fill up my steps, but not on a general basis. It does not give me very much."
	"I was very happy in the beginning (when the clock was new), I got fireworks and stuff, but now I don't really care that much anymore. But I want the functionality because it's nice and fun, so would not be without it."
	"It's boring when you do not reach the goals, but I do not think much more about it."

from runs were important to all the participants, and that this was a fun way to analyze and compare workouts and progression.

Three of the participants agreed that the everyday activity tracking functionalities were unknown, and irrelevant, when purchasing the wearable. Although, many of these functionalities motivated them to start using the wearable all the time, instead of just while exercising. One of the most used among these were sleep tracking, three of the participants were very amused by this feature. Two of them even mentioned that they used this feature to analyze their week, and how their sleep affected their workout, efficiency at school and generally their mental health.

There was a common agreement that notifications connected to the phone was a disturbing functionality, and everyone had muted this. Another functionality that was not very popular was the "move" function. This functionality tells the user to get up and move, when they have been sitting still for too long. Everyone had muted this as well, except for one, yet this person mentioned that "it has never happened that I have moved, when this 'move'-notification has told me to move. I do not care for it ".

The 'goals' functionality were mentioned as well. The user can create goals, or the wearable creates some automatically, like walking 10 000 steps a day, or running a given distance per week etc.. The participants all agreed that it was fun to reach goals. Yet, they did not care if they failed to reach their goals, because of their lack of motivation towards this kind of gamification feature. An exception for this lack of motivation was when the margin to reach the goal was insignificant, i.e. "I don't care on a regular basis, but right before I went to bed the other day I had 90 steps left to reach my goal. Then I wandered around in my apartment to reach this goal".

V. DISCUSSION

Most of the findings about what generally motivates the use of wearables, corresponds with the previous research. What distinguishes previous research from this research is the user group, as the research question defines; which features in wearable fitness trackers provide the highest incentive for long-term use among university students?

It is interesting to note how many m-health applications from 2014 and earlier, only allow users to share workout sessions to Facebook [1]. This is a very general social platform that does not seem like an appropriate place to post personal workout achievements, seeing as Facebook users do not necessarily fit within that specific user group of sporty people. The poor implementation, alongside the excessive focus on gamification connected with the social aspect was what the users disliked the most.

The data from the focus group interview shows that there has been a change of preferences, when it comes to the social aspect of sharing data from wearables since 2014. Three out of four participants used Strava, and were highly motivated by the social aspect of the application over a longer period of time. This observation fits well with the Strava revenue and usage statistics from 2021 [11], where the number of users has close to tripled in since 2016. The reason for this may be due to the growing popularity and use of social media in general. In addition, the implementation and user interface of Strava is aimed at a specific user, to create the best user experience as possible in contrast to Facebook. Nevertheless, it is important to point out that one of the participants did not find motivation through the social media perspective, and thus did not use Strava. This shows that even if the social media aspect has gained popularity and appeals to many students, it still does not appeal and motivate all students.

However, the growing popularity of the social aspect has not affected the opinions regarding the gamification aspect. As mentioned initially, both Spillers and Asimakopoulos [7], and Tóth and Lógó [8] pointed out in their research that users

were not motivated by the poor implementation of gamification in their wearables. Unlike previous research, the participants in this research were only students, who often have more experience in gaming than the general population [12], and thus could have been more motivated by this aspect. In any case, the previous research is still in accordance with the findings from the focus group interview in this research. It seemed like the participants thought it was fun to get a badge when achieving a goal. However, the achievements alone did not motivate them to exercise more in the long run. The reason for this lack of motivation is probably based on the indifference towards achieving a badge and the lack of benefits that feels valuable for the user.

Another aspect of motivation in relation to wearables, is the tracking and analyzing data aspect. According to previous research [3], adult users in all ages, are motivated by the data tracking and analyzing of a workout session. This is compatible with the findigns from the focus group interview in this research. This aspect seems to be important to the users, especially since this is the same reason the participants bought their wearable in the first place. Based on the findings from the interview, progression overview is one of the main reasons why tracking and analyzing of workout data is motivating. This motivation is based on the students' desire to improve their workout data, and to compete against themselves. The findings and previous research compared in this paragraph, shows that regardless of health, activity level and mindset, both tracking and progression is something that motivates many users for a long-term use of wearables, both students and adults with a wider age gap.

It is evident that the participants are mostly affected by extrinsic motivation with regards to fitness trackers. This makes sense seeing as most people exercise in order to get fit and be healthy, not just for the fun of it. Data analysis features and social aspects allows the users to get an overview of their own progression as well as comparing their fitness with others. These are useful features that allow users to measure how well they are doing in reaching their overarching goal of becoming fit. It is usually obvious to people whether they have been physically active enough without having a daily goal to reach a certain step count. Furthermore, the extrinsic motivation for achieving such goals are massively overshadowed by the initial goal of becoming fit. In a way, such daily goals do not add anything to the extrinsic motivation that is usually already present for fitness wearable users, and as such the participants responded that they did not feel motivated by it. Ideally the users should be given some incentive to achieve the goal that is unrelated to that of becoming more fit. This could be something like having the users unlock a new cosmetic background image for the watch when they reach a goal.

VI. Conclusion

The research question sought to gain insight into which features in wearable fitness trackers that provide the highest incentive for long-term use among university students. Thanks to the four students who participated in the focus group interview, as well as the authors of existing studies done in the field of m-health gamification, we were able to analyze the answers and extract what seemed to be the general consensus about how motivational different fitness wearable features felt. Overall, several findings corresponds with the previous research, which shows that students' relationship with motivation for long term use of wearables does not differ from other adults'. To summarize, the participants experienced data tracking and analysis to be the most motivational feature. Contrary to findings from previous research, many of the participants also found social aspects to be highly motivational. Gamification features, such as daily goals, were not perceived as being motivational, because they did not add anything useful.

The Covid-19 situation combined with tight time restrictions made it difficult to find a sufficient amount of students for the focus groups, and we only managed to conduct one group interview with four students. This is a way too small sample size to be able to draw any legitimate conclusions, but the results should rather be treated as hints to what could be promising to investigate further in a more rigorous research.

For further research, it would have been interesting to conduct some additional focus group interviews to collect more data to ensure more credible results. We may also look at focus groups including participants who have decided to quit using wearable, since this could give useful insight in which features gave the highest incentive to long-term use and which features did not appeal at all.

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