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# **Influence of Digital Coaching on Physical Activity: Motivation and Behaviour of Physically Inactive Individuals**

TUOMAS KARI & PETRIINA RINNE

**Abstract** Digital wellness solutions and their use have become increasingly common. Respectively, the need to understand their users and usage has increased. A general problem with wellness technologies is that they typically provide feedback through numbers and graphs instead of providing actual guidance. One potential and novel solution for this is digital coaching. This study is one of the first to examine digital coaching features and their influence. We define digital coaching in the context of sports and wellness technology and investigate its influence on physical activity motivation and behaviour of physically inactive individuals. The study is based on thematic analysis of 20 semi-structured interviews conducted for 10 participants who used a novel digital coaching solution for one month. The digital coaching solution was found to be beneficial for physical activity and exercise motivation and behaviour. It assisted the users in many ways through different elements and mechanisms. Further, the benefits also spurred to other aspect of physical wellness. The results are discussed and implications provided.

**Keywords:** • Digital Coaching • Digital Coach • eWellbeing • Digital Wellness • Physical Activity • Wellness Technology • Sports Technology • Motivation • Behaviour • IS use •

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## 1 Introduction

Technological development has promoted the emergence of various new technologies that allow their user to track, measure, and evaluate a multitude of personal activities and biosignals. During the past years, both individual consumers as well as the healthcare sector have become more and more interested to measure and promote health, wellness, and physical performance by using such technologies. Indeed, the number of such technologies in the market has exploded, as their popularity and significance in both individual level and in healthcare has gradually risen.

Wellness technologies often include features for some form of self-tracking. The use of different self-tracking technologies has become a part of daily life for an increasing number of people (McFedries, 2013), and they are commonly used, for example, as tools to promote personal health and wellness (Swan, 2013). There once was a time when these kinds of technologies were designed purely for athletes, but nowadays there is a huge amount of different digital wellness technologies, such as devices, services, and applications aimed for regular users with all levels of physical activity. Indeed, the users of these technologies are a very varying group of users (Kettunen et al., 2017). Wellness technologies are still typically designed and developed for working age or younger population, but their increasing need and potential also among older users has been presented (Carlsson & Walden, 2017).

Whilst technology in general has developed, physical inactivity has become a major global health issue. According to WHO (2017), in a global scale, around 25% of adults and more than 80% of the world's adolescent population are not sufficiently physically active. Insufficient physical activity is the fourth leading risk factor for non-communicable diseases and death worldwide, while physical activity has significant health benefits across all age groups and contributes to the prevention of diseases (WHO, 2017). Researchers in various fields have begun a serious research effort to find solutions to combat the problems of sedentary lifestyle, which are becoming increasingly widespread in our society. One stream of research concerning this has been the investigation of could different wellness technologies be used to promote the physical activity of their users.

Studies on wellness technology use have found that feedback from wellness technologies can heighten the user's awareness of personal physical activity and motivate towards it (e.g., Chan, Ryan & Tudor-Locke, 2004; Faghri et al., 2008; Kang et al., 2009; Kari et al., 2016b; Kari et al., 2017; Wang et al., 2016). However, while tracking wellness related data may result in better awareness of daily activity, it may not be sufficient to maintain the use of wellness technologies (Miyamoto et al., 2016), which can also affect maintaining wellness routines (Warraich, 2016). Thus, providing guidance and goals for using these technologies would probably increase the adherence to using them and subsequently, adherence to wellness related routines, such as physical activity.

A general problem with sports and wellness technologies has been that they are more focused on providing feedback through numbers and graphs instead of providing actual manageable solutions. Research has shown that the users of wellness technologies want clear, relevant, and easy-to-understand feedback from their activities as well as information on how they should go about with their physical activity and exercise. This would likely lead to the use being more goal-oriented (e.g., Kari et al. 2016a; Kari et al. 2017b), which is generally seen beneficial (Locke & Latham, 2002; Shilts, Horowitz, & Townsend, 2004). Thus, providing the users with actual manageable steps, for example, in the form of a personalized workout plans, would increase the possibility of making both the use of the wellness technologies and the behaviour of the users more goal-oriented. One potential solution for this is digital coaching. Schmidt et al. (2015) present a demand for a goal-driven support of fitness goal achievement to be addressed by digital coaching.

We define digital coaching in the context of sports and wellness technology: *Digital coaching* refers to *information technology mediated sports and wellness related coaching activities that are generated by a software without human intervention*. Coaching activities can be any kind of activities that guide, direct, train, or instruct the person being coached.

The interest towards different solutions to fall under the digital coaching definition has increased among users, industry, and healthcare as well as in academia. However, as these digital coaching solutions are quite novel, the number of studies concerning their effects or the experiences that people have with them is still rather limited. Therefore, it is important to kick-start the research on the topic. This kind of research can offer numerous valuable implications for the development and use of technologies with digital coaching features, and further, aid in promoting physical activity.

This study investigates the influence of digital coaching features on the physical activity motivation and behaviour of physically inactive individuals. This will provide new, relevant, and valuable information on digital coaching and technologies with digital coaching features. The main research questions of the study are:

- 1) How is the influence of digital coaching to physical activity motivation and behaviour of physically inactive individuals?
- 2) What are the central aspects of digital coaching that respond to users' needs?

The focus of the study is on the users' subjective experiences. The study is explorative in nature and follows a qualitative approach. The study is based on thematic analysis of 20 semi-structured interviews conducted to ten individual participants. The participants were using a wellness technology with novel digital coaching features for a period of one month.

Our study is one of the first ones to examine digital coaching solutions and their influence. The study presents some highly valuable first insights to digital coaching research and increases the understanding of digital coaching solutions and their use and influence. Our findings will provide the industry and parties working with physical activity promotion

new science-based knowledge and implications, which will assist in designing and developing digital coaching features for wellness, health, and sports, and in planning new kinds of novel interventions to promote physical activity. In addition, our findings can be valuable to the healthcare sector when deploying technologies with digital coaching features to the patients.

## 2 Background

### 2.1 The Digital Coaching Feature Used in this Study

The digital coaching feature used in our study was the *Next Workout Recommendation* feature by Firstbeat Technologies (Firstbeat Technologies Oy, 2018a). It is designed to work as a digital coach. A knowledge base with scientifically validated facts behind the feature can be found from Firstbeat's White Papers and Publications website (Firstbeat Technologies Oy, 2018d). The Next Workout Recommendation feature can be varied to a certain extent depending on the requirements of the (corporate) customer. In our study, the functionality of the feature was as described below.

In the beginning of the use, the user conducts a test with the feature and it provides an estimation of the person's VO<sub>2</sub>max fitness level using "a proprietary method shown to be 95% accurate compared to laboratory measurements". The test can be conducted during any freely performed walk, run, or ride (Firstbeat Technologies Oy, 2017; 2018b). The VO<sub>2</sub>max fitness level estimation (presented as the *fitness level* in the feature) gets more accurate the more the user uses the feature. After the base-level test, the user determines whether s/he is aiming to maintain the current fitness level or to improve it. If the user sets a goal to improve the fitness level, s/he will also get to choose the degree between improve and improve fast. The feature will then create an adaptive target goal for the user. The chosen approach will influence the degree of physiological impact targeted for the given workouts. Based on the background and the goal of the user, the chosen approach, and the estimated base-level of fitness, the feature creates a personalised and adaptive continuous seven-day workout plan that automatically adapts after each workout based on the activities of the user. The feature provides a specific workout or a rest day for each day. If the user misses a session or does the training longer or harder than suggested, the feature takes this into account and adapts the training plan accordingly. Moreover, when the fitness level changes, the feature will adapt the program accordingly: if the fitness level increases, the planned workouts will require more effort to be completed and if it decreases, the planned workouts will become easier (Firstbeat Technologies Oy, 2018c). Thus, the feature is suitable for people with different fitness levels and different physical activity levels, including physically inactive people.

The feature is designed and best suited for aerobic training but places no restrictions regarding the specific sport conducted. If the user chooses so, the feature can also provide real-time guidance during the workout. The real-time guidance communicates to the user to maintain, increase, or decrease the current exertion level, and shows how much of the current workout has been conducted. It also shows when the goal of the workout has been

reached, but the training continues until the user decides to end it. The feature also provides different views that display, for example, the user's progress and various other information. Some of the views contain elements aiming to wake the experience of gamification (Kari et al., 2016b) in the user to further increase the motivation. Such elements include, for example, progress bars, comparison, and levels. An example view is presented in the appendix.

VO2max – the used metric to present the fitness level in the feature – is a metric that defines one's personal aerobic/cardiorespiratory fitness level. It describes the body's capability to bring oxygen into the body through the lungs, transport it through the circulatory system to the muscles, and use it as part of body's energy production method. Higher VO2max scores are strongly related to not just aerobic performance but also health and longevity in general (Firstbeat Technologies Oy, 2018b). For more detailed description of VO2max, see (Firstbeat Technologies Oy, 2017).

## 2.2 Goal Setting

Goal setting can be an important facilitator for behaviour change (Locke & Latham, 2002; Shilts et al., 2004) and it provides a potential strategy for transforming physical activity information into practical actions (Shilts et al., 2004). To be effective, goal setting requires some form of self-tracking to better support the realisation of goals and the increase in self-efficacy (Fukuoka et al., 2010; Locke & Latham, 2002; Shilts et al., 2004). Goal setting can be viewed through three central dimensions: 1) self-set goals – assigned goals – participatory goals; 2) personalised goals – non-personalised goals; 3) fixed goals – adaptive goals (Zhou et al., 2018). Despite self-set goals typically being of highest personal importance, a literature review (Shilts et al., 2004) on goal setting shows that assigned goals are more effective in comparison to self-set goals (Zhou et al., 2018). Studies have also shown that interventions utilising wellness technology with fixed and non-personalised physical activity goals are often significantly less effective than interventions with adaptive goals (Adams et al., 2017; Adams et al. 2013; Jakicic et al., 2016; Zhou et al., 2018) or with personalised goals (Chan et al., 2004; Jakicic et al., 2016; Tudor-Locke, 2002; Zhou et al., 2018) in increasing physical activity levels. The weakness in providing fixed and non-personalized goals to all users is that in many cases it irresistibly leads to either goals that are too high or even unrealistic or too low and unchallenging. This obviously decreases the effectiveness of the goal setting (Tudor-Locke, 2002; Zhou et al., 2018) and leads to non-optimal behaviour. Studies have also shown that in the case of sports and wellness technology, the utilitarian goals are one of the important drivers behind use intention (Makkonen et al., 2012a; Makkonen et al., 2012b). Thus, the adaptive and personalized goals and training plans provided by the Next Workout Recommendation feature pose much potential regarding physical activity and fitness.

### 3 Methodology

The basic setting of our study included participants who implemented the Next Workout Recommendation digital coaching feature into use for a period of one month. Due to its novelty, at the time of the use period (September-October 2017), the Next Workout Recommendation feature was not yet implemented on any commercial physical devices, though the first products implemented with it were released not long after (early 2018). Therefore, the participants used a mobile application version (provided by Firstbeat) that was installed to their smart phones before the use period started. For clarity, we refer to the used Next Workout Recommendation feature as application in the remaining of the paper. All the participants were also given a heart rate belt and personally instructed on how to use the application and how to interpret the received information. As physically inactive individuals seldom want to maintain their current fitness level but rather to increase it, all the participants were set with a goal of improving fitness level in the application (*improve* approach). The application then created and provided each one with a personalised target goal to be aimed for in one month and started providing the users with adaptive continuous seven-day workout plan to reach that target goal. As the aim of the study was not in increasing the physical fitness levels of the participants per se but to investigate the application's influence on motivation and behaviour, we did not require the participants to conduct every workout the application suggested, but rather wanted the use to be as natural as possible. Thus, it was a voluntary choice to do or not to do the suggested workouts. This kind of autonomy is also central in the self-determination theory (Ryan & Deci, 2000).

To conduct our study, we chose a qualitative approach. Qualitative research aims to understand people, their sayings and behaviour, as well as the cultural and social context they are living in. The goal is to find new knowledge and understand real life phenomena. One of the central benefits of qualitative research is enabling the researcher to see and understand the underlying contexts in which decisions are made and actions take place (Myers, 2013).

To collect the data, we chose interviews as the data collection method. According to Myers & Newman (2007, p. 3) qualitative interview is the "most common and one of the most important data gathering tools in qualitative research". More precisely, we chose a semi-structured interview, which is the most used type of interview in IS research. In a semi-structured interview, there is an incomplete script, but it is typical that some pre-formed structure is prepared that the interviewer follows (Myers & Newman, 2007). This was also the case in our interviews. In planning and conducting the interviews, we followed relevant guidelines (e.g., Guest, Bunce & Johnson, 2006; Myers, 2013; Myers & Newman, 2007) regarding semi-structured interviews. The goal was to gain maximal benefit from using the method and to avoid the potential problems and pitfalls.

We conducted two interviews for each interviewee, one before and one after the use period. The first one mainly focused on the expectations towards the application and its influence, whereas the second one focused mainly on the experiences and perceived

influence of using the application on physical activity and exercise motivation and behaviour. Therefore, two distinct interview scripts were created. One for the interviews before (Script 1) and one for the interviews after (Script 2) the use period. It is to be noted that the interviews also included themes for a purpose of another study. However, this cannot be seen to affect the results of this study. However, it affected the development of the scripts so that they also included themes and questions deriving from theories less connected to this particular paper. The themes for Script 1 were mainly developed based on the research questions, previous literature, and the theoretical background, while some themes also derived from the UTAUT2 (Venkatesh, Thong & Xu, 2012) and innovation-decision process (Rogers, 2003). Script 2 included the same aspects but focusing more on the experiences from the use period plus questions deriving from self-determination theory (Ryan & Deci, 2000). The themes of both interviews are presented in the appendices. But as mentioned, not all themes were used in this particular paper. Following Myers and Newman (2007), the interviews included the opening, the introduction, key questions related to certain themes, and the closing.

To recruit the participants, we used a snowball sampling approach (Patton, 2002). First, we searched persons that met the criterion and then suggested them with the possibility to participate in the study. Then, the selected participants were asked for and provided information on additional potential participants and these again were contacted. Following McCracken (1988), in selecting the interviewees we aimed for a fairly homogenous sample that share critical similarities concerning the research question, this way aiming to maximise the richness and depth of the data. In addition, certain criteria were used: 1) the person was physically inactive at the moment, 2) the person had the possibility and interest to implement the application into use, and 3) the person was motivated to take part in the research.

In the end, the study was conducted with ten participants. We conducted 12 interviews before the use period, but had two dropouts during the use period due to sickness affecting not being able to exercise. Thus, we conducted 10 interviews after the use period. We did not include the interviews from the two dropouts in our analysis. The first round of interviews was held early September 2017 before the use period began, and the second interviews during November 2017 by one of the authors. The interviews were held face-to-face with the interviewee, with the exception of one interview that was conducted via mobile phone. On average, the interviews lasted 25 and 49 minutes. The interviews were recorded and transcribed (in the interviewees native language). Based on the transcriptions and notes made during the interviews, the analysis began.

For the purposes of this particular paper, our analysis mainly focused on the data collected with the second-round interviews. To analyse the data, we used thematic analysis, which is the most widely used method of analysis in qualitative research (Guest, MacQueen & Namey, 2012). Thematic analysis is a method for “identifying, analyzing and reporting patterns (themes) within data” (Braun & Clarke, 2006, p. 79). Using thematic analysis, a researcher can organise and describe the data set in rich detail, and typically go even deeper by interpreting various aspects of the research subject (Braun & Clarke, 2006). In



addition to identifying, analysing, and reporting the themes in our data, we also aimed to interpret various specific related aspects and exceptions. In conducting the analysis, we applied guidelines from Braun and Clarke (2006) and Patton (2002). As they suggest, these guidelines were applied flexibly to fit the research questions and the collected data. Further, as suggested, the analysis process was not a linear phase-to-phase process but a recursive one, in which we moved back and forth between the different phases of the analysis.

#### 4 Results

The ten participants consisted of five females and five males with the mean age of 31,6 years. The description of each participant can be found in Table 1. In general, the participants had rather little previous experience on using sports or wellness technology. Only two owned some such device at the moment, but neither of them was using it actively. The physical activity background of the participants varied a lot. Some had a more active history through some hobby and some had even competed earlier in their life, whereas others had been more or less physically inactive their whole life and regarded themselves as beginners in terms of exercise. However, it is to be noted that even though some participants had been more physically active in the past, at the moment when the use period started, they all considered themselves to be physically inactive, and at most, taking part in exercise activities was occasional. Everyone also perceived their current aerobic fitness level as low or fair at best.

**Table 1: Description of the Sample**

Participant	Gender	Age	Physical Activity Background	Previous Experience on Sports Technology
1	Female	34	Competition history	Heart rate monitor
2	Female	28	Beginner	–
3	Male	28	Competition history	–
4	Female	21	Beginner	–
5	Male	33	Competition history	Mobile applications
6	Male	41	Competition history	Heart rate monitor
7	Male	30	Hobby history	Heart rate monitor, app
8	Female	25	Competition history	Mobile applications
9	Female	51	Competition history	–
10	Male	25	Hobby history	Pedometer (in a phone)

#### **4.1 Influence of Digital Coaching to Physical Activity Motivation and Behaviour**

The digital coaching application was found to be beneficial for physical activity and exercise motivation. Each of the participants reported that their motivation towards physical activity had increased during the use period. The element that most affected the motivation was reported to be that someone told what to do and how to do it. Also, being able to follow one's own progress was perceived as highly motivational. Another aspect that influenced the motivation was that the digital coach had a role in changing the person's whole mentality regarding physical activity. Many reported that they had previously had different kinds of challenges that inhibited being physically active, for example, related to false assumptions regarding how they should exercise. The application was also perceived to be a better motivator than most of the previous things that the users had tried, as the application was more capable in solving those challenges that the users had previously experienced.

The application was also able to make the physical activity more goal-oriented. The users wanted to accomplish the goals of individual workouts, and achieving those was perceived as steps in achieving the overall goal of improving fitness. Workout specific goals were reported to be sufficiently short-term, and thus, easier to achieve and good in maintaining motivation. Further, the users reported that if they only had a much larger goal to achieve at once, it would likely feel unachievable and subsequently lower the motivation. Achieving these smaller workout specific goals was perceived to increase personal capability towards exercise and additionally make one proud of him or herself, further increasing the motivation.

Seeing the upcoming workouts from the application was perceived as very interesting, and many reported to be waiting for the moments when they received updates to their adaptive workout plan. The length or the exertion level of the upcoming workout did not affect whether the users planned to go perform it or not. In addition, being able to see the workout plan beforehand helped in organising the day's schedule and the daily life in general, which for some was a big but positive change. This aided in fitting physical activity into the daily routines and transforming the increased motivation to actual physical activity behaviours.

The digital coaching application also influenced the users' actual behaviours in many ways. First of all, it increased their level of physical activity. Whereas many had felt exercising challenging for one reason or another before implementing the application, the application lowered the level of starting a workout by providing a ready-made plan and guidance to individual workouts. Further, it helped to realise that being physically active and doing workouts is not actually that demanding as they had thought. Everyone reported that the application had developed their habits and ways of being physically active.

The application also changed the way they conducted their individual workouts. Many reported that when they had previously tried exercising for a while, they had done so with a much higher exertion level, because they had thought that for a workout to be beneficial, one has to go all out. Thus, they usually had exercised too hard and subsequently been exhausted after each workout, which had made them feel negative towards exercising and stop it altogether. Instead, now they felt that the exercise intensity during the workouts had been much lower and more pleasing, which subsequently had made them experience better feeling during the workout and also after it. The real-time guidance had a major role in keeping the right heart rate and exertion level during the workouts, and also in teaching the users how certain kinds of workouts should feel physically. It also motivated to keep going until the goal of the workout had been reached, especially when they didn't otherwise feel so keen on exercising. Indeed, even though the application had made the feeling during and after the workouts more pleasing, it did not magically make everyone enjoy every aspect of exercising all at once, and the sofa was still seen as an intriguing option, yet one that was chosen much less frequently than before.

Reaching the workout specific goals was perceived important and trust towards the application was strong. Therefore, the real-time guidance was generally followed quite accurately. However, this also had its downside. If one wanted to follow the real-time guidance accurately, it made social exercising more difficult. The need to follow a certain exertion level for a certain time was sometimes seen as difficult to do together with someone else. Though some also reported that the application and especially its real-time guidance made them feel like they had a companion when exercising alone.

Receiving a plan also affected other aspects of life than just physical activity. The users reported that they had started to pay more attention to nutrition and proper breakfast or skipped drinking alcohol if they had a workout planned for the next day. In other words, the application did not just influence those moments of exercise but also the time between them. Almost everyone reported that their appreciation towards physical wellness had changed during the use period. As they had been physically more active, they had noticed it influencing their sleep positively and made them pay more attention to their nutrition and eating rhythm. Everyone planned to continue being more physically active also in the future.

#### **4.2. Central Aspects of Digital Coaching Regarding Users' Needs and Challenges**

Digital coaching can answer to various kinds of needs and bring solutions to various challenges. However, we also found certain aspects that should be paid more attention to in the design process. The most notable need that the application answered to was providing the users personalized workouts suited for their personal fitness level, doing of which had previously been challenging to many. This led the user to exercise with right exertion level and frequency. The ready-made workout plans also decreased the perceived stress regarding physical activity, as the planning and tracking was done by the application. The users also reported that despite not necessarily having a particularly good

overall knowledge on physiology, it didn't matter, as the application in a way took care of that part. The perceived advantage over optional wellness technologies without digital coaching features was evident, and everyone would have been willing to pay for such digital coaching features alone.

The three most central features regarding matching own previous needs and challenges were reported to be personalised workout plans, real-time guidance, and the ability to follow own progress. Personalisation was especially highlighted and appreciated. It was also highly regarded that the application was able to adapt the workout plan based on the user's activity, for example, if one had overachieved or in contrast skipped a workout. An additional need that the application answered to was the ability to start a guided workout straight from one's own door, without the need to separately go for a group workout session in a gym, which could be challenging due to requiring more time and having a higher starting step.

One interesting finding was that the application was perceived to be as any coach or personal trainer in a sense that the users would have wanted to communicate with it more. For example, if a user knew beforehand that s/he was unable to conduct the upcoming workout due to work, travel, not feeling well, or another obstacle, s/he would have wanted to tell the digital coach this, so that the coach could have moved the workout for the day before or otherwise adapt the plan. Some also had specific weekdays when they were never able to conduct workouts due to other hobbies. It also seemed to us that among some users, the application had roused a sense of obligation towards the digital coach, and they would have wanted to explain why they were unable to conduct certain workouts. Thus, it can be said that for some, the interaction with the digital coach application had some human characteristics in it.

Even though the users mostly perceived following the development of their fitness in a general level as clear, for some, presenting the actual values and fitness level through VO<sub>2</sub>max was difficult to comprehend. They had difficulties in understanding the scale and what kind of changes in VO<sub>2</sub>max would be realistic in the first place. It was also wished that the application would have notified about increased fitness level with more clarity and accompanied rewarding.

Some elements of the real-time guidance were also reported to have waken the experience of gamification, for example regarding reaching own goals. Those elements were liked and some expressed they would have liked to see more of such elements in the application. On the other hand, even though it was generally wished that the application would have provided further (digital) rewards, the users would not have wanted it to exaggerate accomplishing goals of individual workouts, as the most important feeling of success came from within.

The application did not provide separate reminder notifications for the users about individual workouts. Whether it should have divided opinions. Whereas some would have

valued daily notifications of the next workout, some reported that it might have felt pressuring.

The users reported that they had learned much from using the digital coach, for example, about heart rate levels and how to exercise according to them, how a certain exertion level should feel, and scheduling the workouts into the daily life. Finding the solutions to these needs and challenges would influence the ways of exercising in the future.

## 5 Conclusions

The purpose of this study was to increase the understanding of novel digital coaching solutions and their use. More precisely, we investigated the influence of digital coaching features on the physical activity motivation and behaviour of physically inactive individuals. The focus was also on central aspects of digital coaching that respond to users' needs. In our qualitative study based on interviews and thematic analysis, the participants used the Next Workout Recommendation digital coaching feature by Firstbeat Technologies for one month. We also provide a definition of digital coaching in the context of sports and wellness technology: *Digital coaching* refers to *information technology mediated sports and wellness related coaching activities that are generated by a software without human intervention*. Coaching activities can be any kind of activities that guide, direct, train, or instruct the person being coached.

The application with the digital coaching feature was found to be beneficial for physical activity and exercise motivation. The element that most affected the motivation was some outsider, in this case the digital coach, instructing the what, when, and how regarding exercise. Further, knowing that these instructions were targeted specifically to them as individuals and based on their personal fitness level and actions was much appreciated and perceived important. Also, being able to follow personal progress was perceived highly motivational. The application was also able to make the whole physical activity regime more goal-oriented, which had a further motivating effect.

The application also aided in fitting physical activity into the daily routines and transforming the increased motivation to actual physical activity behaviours. The digital coaching application influenced the users' actual behaviours in many ways. First and foremost, it was able to increase the level of physical activity for these previously physically inactive individuals. It also guided and taught them to conduct their workouts with appropriate frequency and exertion level, which subsequently led them to enjoy exercising more and get more positive feelings after the workouts. Thus, the application was able to shift their whole mentality regarding physical activity and fitness to more positive direction.

The digital coaching feature influenced also other aspects of life than just physical activity. The users had started paying more attention to, for example, nutrition, diet, sleep, and alcohol consumption. In other words, the application did not just influence those

moments of exercise but also the behaviours in between them. Subsequently, it increased the general appreciation towards physical wellness in a positive way.

The application was able to meet several kinds of needs and give solutions to various previously felt challenges. Thus, it seems that a digital coaching feature like the one used in our study can really be beneficial. At least among physically inactive individuals and on a short-term. As the use period lasted only one month, it is difficult to draw longer-term conclusions. Also, the needs and challenges of, for example athletes, can be very different. Thus, the particular digital coach used in our study might not be so influential and successful among other user groups, and more research is needed in that regard. The digital coaches should indeed be designed with the target group in mind, first investigating the target group.

One interesting finding was that the digital coach was perceived as any coach or personal trainer in a sense that the users would have wanted to communicate with it more, for example, regarding upcoming or missed workouts. This is something for the designers to acknowledge. They should provide communication and interaction possibilities between the user and the digital coach. The users clearly want to explain if they are not or have not been able to follow the plan and want the digital coach to adapt the workout plan accordingly. Also, as the users clearly perceived the interaction with digital coach to have human characteristics, the digital coaches could have some human like avatars or similar. As for further practical implications, it would probably be valued if the digital coach could better be able to adapt individual workouts so that it would better support social exercising, should the user want to exercise with a friend for example. In the beginning of the use, the metrics used to display fitness level should be thoroughly explained. The users could also be provided with different options regarding the metrics, so they could choose between different metrics based on their own will and background knowledge. The designers should also undertake the process of gamification (Kari et al., 2016b) and implement digital coaches with gamified features. But needing to be careful not to overemphasise individual elements or overgamify the use. Special attention should also be paid to conducting the base-level tests as accurately as possible. If the digital coach would estimate the user's base-level incorrectly and with relatively high error, it would probably lead to wrong kinds of plans and individual workouts and to presenting the progress in physical fitness falsely. Nevertheless, even with the need for great accuracy, conducting the base-level test should still be easy and effortless enough also for physically inactive users, who do not necessarily possess much knowledge on physical activity. This is one of the main challenges for the designers to overcome.

To conclude, this study is one of the first ones to examine novel digital coaching solutions and their influence. Increasing the understanding of digital coaching solutions and their use and influence, the study provides highly valuable first insights both for the researchers and for the wellness and sports technology providers. The industry as well as the actors working with physical activity promotion can utilise our findings and implications in designing and developing digital coaching features for wellness, health, and sports, and

in planning new kinds of novel interventions to promote physical activity. The study also lays foundation for future research on digital coaching.

## 6 Limitations and Future Research

There are few notable limitations in the study. First, although the interviews provided a very valuable set of information, the number of participants in the study could have been higher. The study had to consist of physically inactive people willing to implement a sports technology application with digital coaching features into use, which is not the most typical of target groups, though a highly important one. However, all interviewees had interest towards the solution, and thus, the implementation was based on own interest. We also followed previous guidelines (McCracken, 1988) in selecting the interviewees. We also believe that an adequate number of interviews were conducted, as we recognised that their marginal benefit was notably reduced. Second limitation concern the relatively short usage period of one month, which reduces the ability to make long-term interpretations. However, from a physical point of view, a month is considered long enough to be able to see changes in fitness level, especially among people with below average fitness level (Jürimäe et al., 1985).

Third limitation relates to the general limitations of qualitative interview. To overcome these, we followed well-established guidelines for semi-structured interviews in planning and conducting the interviews (e.g., Braun & Clarke, 2006; Guest et al., 2006; Myers, 2013; Myers & Newman, 2007). This, we believe, enabled us to avoid the possible problems and pitfalls and helped us to gain maximal benefit from using a semi-structured interview. As Guest et al. (2012) point out, the identified themes in the thematic analysis are always based on the interpretations of the researchers. Therefore, we also applied relevant guidelines in doing the analysis. As is typical to qualitative research, it is difficult to make generalizations from the sample to a larger population (Myers, 2013) and one should be cautious if doing so.

Despite these limitations, the research offers some highly valuable first insights and a good overview on the subject. The findings of the study also provide potential paths for future research. Being one of the first studies to examine these kinds of digital coaching solutions and their influence, it can serve as a starting point and a reference to future studies. Future research would benefit if to be conducted with larger samples and longer use periods. The target group could naturally also be other than physically inactive people, as digital coaching has the potential to be beneficial for people with all levels of physical activity and fitness as well as for people of different ages. Future studies could also specifically focus to certain types of users who share similar goals, for example, regarding a certain sport, certain competition, physical ability, weight loss, or other specific area. We would also encourage researchers to conduct more research in regards to digital coaching and the different aspects of it, not just from the IS perspective but from other perspectives as well, for example, health and exercise science and psychology. Thus, we make a call for cross-disciplinary research on digital coaching and their effects on human behaviour and wellbeing.

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## Appendices

### Appendix A: Themes of the 1st round interviews

1. Background	1.1 <i>Demographics</i>	1.2 <i>Socioeconomic characteristics</i>
2. Physical activity background and meaning of wellbeing	3. Previous experience	4. Innovativeness, personality variables
5. Challenges and needs with physical activity	6. Performance expectancy and personal goal setting	7. Effort expectancy and facilitating conditions
8. Hedonic motivation	9. Habit	10. Physical activity and exercise motivation
11. Social aspects		

More detailed descriptions with key questions are available from the authors by request.

### Appendix B: Themes of the 2nd round interviews

1. Meaning of wellbeing	2. Use experiences	3. Social aspects
4. Challenges and needs with physical activity	5. Performance experience and personal goal setting	6. Effort experience and facilitating conditions
7. Hedonic motivation	8. Elements of the solution and physical activity motivation	9. Habit
10. Relative advantage	11. Adaptability	12. Price value
13. Physical activity and exercise motivation	14. Other aspects	

More detailed descriptions with key questions are available from the authors by request.

## Appendix C: An example view of the Next Workout Recommendation Feature



