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Digital Coaching among University Students with Low Levels of Physical Activity: A Quantitative Intervention Study on Exercise Self-efficacy

EEVA KETTUNEN, TUOMAS KARI, MARKUS MAKKONEN, WILL CRITCHLEY & ANNA SELL

Abstract University aged people have been found to be at a high risk of disengagement of physical activity. They also belong to a generation where technology is strongly integrated into most parts of their lives. Therefore, using technology also in physical activity promotion has potential. This exploratory study investigates the perceived effects of a sport and wellness technology digital coach among physically inactive university students during a 10-week intervention. The perspective for the research came from exercise psychology focusing on the effects of the use of a digital coach on self-efficacy related to physical activity and exercising. The results indicate that a digital coach can increase the user's self-efficacy and awareness regarding their own exercising. However, the results also show that further development could be done for digital coaching to reach its full potential. These results give more insight to sport technology companies as well as to coaches and trainers about the effects and possibilities of digital coaching among physically inactive people.

Keywords: • Digital wellness • Physical activity • Digital coach • Self-efficacy • Students • Sport and wellness technology • Intervention

CORRESPONDENCE ADDRESS: Eeva Kettunen, M.Sc., Ph.D. student, University of Jyvaskyla, Faculty of Information Technology, P.O. Box 35, 40014 Jyvaskylan yliopisto, Finland, e-mail: eeva.k.kettunen@jyu.fi. Tuomas Kari, D.Sc., Postdoctoral Researcher, [1]Institute for Advanced Management Systems Research, Juhana Herttuan Puistokatu 21 A 2052, 20100 Turku, Finland, [2]University of Jyvaskyla, Finland, e-mail: tuomas.t.kari@jyu.fi. Markus Makkonen, M.Sc., Ph.D. student, University of Jyvaskyla, Faculty of Information Technology, P.O. Box 35, 40014 Jyvaskylan yliopisto, Finland, e-mail: Markus.v.makkonen@jyu.fi. Will Critchley, M.Sc., University of Jyvaskyla, Faculty of Sport and Health Sciences, P.O. Box 35, 40014 Jyvaskylan yliopisto, Finland, e-mail: wcritchley@gmail.com. Anna Sell, D.Sc., Senior lecturer, Abo Akademi University, Faculty of Social Sciences, Business and Economics, Fanriksgatan 3A, 20500 Turku, Finland, e-mail: anna.sell@abo.fi.

1 Introduction

People who are of university age have been found to be at high risk of a sedentary lifestyle (Cocca et al., 2014, Downes, 2015). Physical inactivity is also significant problem around the world due its negative effects on overall health and wellbeing (WHO, 2017). In university students, a sedentary lifestyle has been linked to increased levels of anxiety, stress, and depression (Lee & Kim, 2019). As young people transit from secondary school to university, they are at heightened risk of decreased physical activity (Vella-Zarb & Elgar, 2009). Therefore, it is important to find a variety of methods to increase the level of physical activity and to prevent disengagement from physical activity.

Young people who are born between 1977 and 1997, are called the "Net Generation" by Comegys et al. (2006) meaning that they have had a chance to use information technology throughout their entire lives. Most of today's university students also fall into this category. By being familiar with technology and being used to integrate it in different parts of life, it is worth studying whether technology has potential to motivate this generation also towards more physically active lifestyle.

Since sport and wellness technology devices are becoming more popular and less expensive, not only athletes but also regular exercisers have started to combine technology into their training. According to previous research, feedback sources are considered more relevant and effective during the beginning of skill acquisition (Winstein and Schmidt, 1990). Therefore, sport and wellness technologies are suitable also for recreational exercisers who are in the initial level of skill acquisition and whose knowledge level regarding exercising has not reached its peak (Liebermann et al., 2002).

According to previous studies, sport and wellness technology has potential in increasing user's motivation by increasing the level of awareness regarding personal physical activity. (e.g., Chan et al., 2004; Faghri et al., 2008; Kang et al., 2009; Kari et al., 2017a; Wang et al., 2016). However, the increased awareness regarding one's physical activity alone may not lead to maintaining the use of sport and wellness technology (Miyamoto et al., 2016) This might subsequently also affect the overall maintenance of physical activity routines (Warraich, 2016). Adding personalized achievable goals, sufficient usage guidance, and clear and easy to understand information might increase adherence and help users to maintain their motivation and exercise routines. Receiving feedback on how to enhance or maintain overall wellness and physical activity can make users more goal oriented (e.g., Kari et al., 2016; Kari et al. 2017b), which can lead to increased motivation (Locke and Latham, 2002; Shilts et al., 2004).

Many current sport and wellness technology devices and applications concentrate on giving data and feedback related to past performance and do not provide personalized information or instructions on what to do next. This is problematic considering users who do not possess knowledge and experience about exercising and who would like to rely on instructions received from external sources.

One potential solution for this problem is digital coaching, which refers to a "service on a technological device that not only gives feedback but also offers advice, suggestions and future steps for a user to follow in the pursuit of their wellness and fitness goals" (Kettunen & Kari, 2018, p.3). While more traditional sport and wellness technology devices and applications focus on increasing awareness by giving feedback on performance data, a digital coach goes one step further by creating for the user an individualized training plan. A digital coach can potentially identify the strengths and weaknesses of a user, and also update the personalized

training plan based on user's performance and development (Schmidt et al., 2015). The potential of a digital coach regarding physical activity and exercise has also been recognized in other previous research (Kranz et al., 2013; Kari & Rinne, 2018; Kettunen & Kari, 2018; Kettunen et al., 2018; Kettunen et al., 2019).

Since the commercial sport and wellness technology digital coaching devices and solutions are relatively new, there has not been many studies focusing on the effects or the usage experience of this technology. However, since interest towards digital coaching is growing it is worthwhile to continue studying further digital coaching solutions and their effects especially in a physical activity and wellness context.

This study continues the important investigation on the usage experiences of digital coaches focusing more closely on the exercise psychological perspective. More precisely the aim of this study is to find out whether the use of a sport and wellness technology digital coach has an effect on exercise self-efficacy of people who are physically inactive but interested in pursuing more physically active lifestyle. The main research question this study seeks to answer is: *Can the use of a digital coach affect self-efficacy related to physical activity and exercising within physically inactive people?*

The concept of self-efficacy was chosen for the study due to its significant relationship to physical activity performance affecting the choice of activity, effort expenditure, persistence level and vulnerability to stress and depression (Bandura, 1997).

The study included 59 participants who were all physically inactive university students but who were interested in increasing the level of their physical activity. The study lasted for 10 weeks and the participants were divided into intervention and control groups where the intervention group was given a sport and wellness technology digital coach. Online self-assessment surveys were sent to all participants in the beginning, middle and the end of the study period. The survey measured the participants' self-efficacy and opinions related to a digital coach. The findings of the study provide interesting first insights on the use of digital coaching solutions and aim to encourage future research on digital coaching especially from an exercise psychology perspective.

2 Theoretical Background

The theoretical background for this study comes from Alfred Bandura's (1977) theory of self-efficacy. Self-efficacy refers to a person's beliefs regarding his or her own capabilities of performing a specific task. People with high self-efficacy tend to view difficult tasks as opportunities to overcome a challenge, whereas those with lower self-efficacy may tend to avoid tasks that are perceived to be difficult. Motivation may also be affected by self-efficacy because it may affect the amount of effort a person is willing to put in, particularly in the face of obstacles. When there are moderately challenging tasks that can be overcome, people may experience satisfaction of accomplishment and therefore increased motivation, while motivation may decrease with tasks that are perceived as either too easy or too difficult relative to their own perceived skill level (Bandura, 1998).

Within self-efficacy theory, there are four sources of information that may affect self-efficacy: performance accomplishment, vicarious experience, verbal persuasion, and physiological states (Bandura, 1998). Performance accomplishments are based on positive past performances and are considered the most influential source of self-efficacy. Vicarious experiences are received when observing other people performing a skill. Verbal persuasion simply means

receiving comments or feedback from others. Finally, physiological state relates to how a person perceives their physiological reactions to an experience, specifically their emotional arousal, such as their stress reactions from a particular situation. The self-efficacy construct is one aspect of Bandura's social cognitive theory (1986) which suggests that a person's actions, reactions, and social behavior are influenced by their observations of the actions of others. The social cognitive theory highlights the role of social experience and observational learning in personality development and has often been used as a framework theory for studies focusing on motivation and physical activity. Within the field of self-confidence in sports performance studies, the theory of self-efficacy is one of the most widely used.

In this study, the theoretical background of self-efficacy has been studied from the perspective of physical activity and exercise and therefore the focus can be said to be on exercise self-efficacy. Exercise self-efficacy is being studied from the point of view of a person who is not physically active enough but would like to become more physically active and start exercising. The concept of self-efficacy was chosen for the study since it has been demonstrated to have high influence in the adoption of physical activity (McAuley & Blissmer, 2000) and especially during the phase when physical activity has not yet become habitual (Bandura, 1986). Exercise self-efficacy has also been associated with the long-term maintenance of physical activity (Mc Auley et al., 2011).

People with a high level of self-efficacy will also participate more frequently, put in more effort and also persist longer, enhancing their performance (Bandura, 1986) for example in exercising. Therefore, self-efficacy has an important role in everyday life when trying to improve one's fitness and become more physically active. Self-efficacy is one of the most widely researched concepts in the field of health promotion (Kroll et al., 2007) and sports performance (Feltz, 1988).

3 Methodology

3.1 The Digital Coach Used in the Study

The device that provided the digital coaching in this study was the Suunto 3 Fitness, created by Suunto Oy (Suunto, 2019). The device is a fitness monitoring watch, which includes wrist-based heart rate detection, exercise timing and stopwatch features, 24/7 activity tracking including sleep monitoring, stress and recovery measurements, step and calorie counting, as well as additional features when pairing the device with Suunto's mobile phone app. The device may also receive speed and distance information from a phone's GPS information.

The Suunto 3 Fitness also includes a digital coaching feature, an adaptive training coach that can provide training instruction directly on the watch. The personalized training plan created in the watch is based on a user's estimated fitness level. The fitness level may be calculated using a guided fitness test, or the device may make an automatic fitness level calculation based on previous workout data. The user can also select a fitness goal, from three options, "maintain", "improve", and "boost", "boost" being a goal that aims to improve fitness level at a faster rate than in the "improve" program. The different goals will change the amount of training load that is recommended, and the goals may also be changed at any time.

Based on the user's fitness level, the device's digital coach will provide a recommendation for the next day's workout. It will also display a general presentation of what the next 7-days of the training program will be, as well as a text list of the workouts. The next workout

recommendation may be a rest day, or may be some sort of training target, usually in a measure of time (in minutes), as well as a recommended intensity, usually in the form of "easy", "moderate", or "hard".
When the user performs the recommended workout, the device will provide real-time guidance. The guidance is based on staying within the designated heart rate zones. The watch will have visual indicators showing the user's heart rate and where it is within the target zone. It will also show a progress bar showing how much of the workout has been completed. If the user's heart rate leaves the recommended the target zone, there will be a visual notification, watch vibration, and the device will provide an audio notification, all of which will specifically tell the user to lower their heart rate (by slowing down), or raise their heart rate (by speeding up). The user will then be notified when the workout has been successfully completed.
The resultant data from the workouts may be used to adjust future workouts, being made harder or easier based on the changing fitness level of the user. This may also include if the user performed the workout and it appeared too easy or too hard. If the user does a completely different workout than the recommended workout, subsequent workouts will also be adjusted to maintain the training targets.

3.2 Data collection and analysis

The study was conducted as an intervention study using an intervention group and a control group. The target population was university students who reported being physically inactive in the sense of not meeting the physical activity recommendations but who wanted to have a more physically active lifestyle. The invitation to take part in the study was sent to all students studying in the authors' universities via student online magazine. The students were also recruited using snowball sampling method. In total, 67 students volunteered to take part in the study. Out of all the volunteers, 7 students did not meet the criteria of being physically inactive enough and were excluded from the study.
The study had two sub groups, an intervention group, including 30 participants and a control group with 29 participants. The control group originally also had 30 participants but one participant dropped out during the study. The first 30 students who expressed their interest in taking part in the study and training with a digital coach and whose background fit the requirements, were chosen for the intervention group. The reason for limiting the number of participants to 30 was due to the number of available digital coach devices. The other suitable students who expressed their interest to take part of the study but were not chosen for the intervention group, formed a control group. The recruitment process was stopped when 30 participants were found for each sub group.
The duration of the study was approximately 10 weeks. During that time the intervention group was using a digital coach along with their exercising whereas the control group participants did not receive a digital coach. At the beginning of the study, the participants in both groups were surveyed for the first time by using an online survey. After the first survey the intervention group was given the digital coach devices. The participants were asked to use the device in a way that was most suitable for them. Half way through the study, after 5 weeks, both intervention and control group received another online survey. The third and last survey was sent to them in the end of the 10-week intervention.
In the three online surveys, the measurements were conducted identically for both groups. The survey questionnaire contained an exercise self-efficacy scale by Kroll et al. (2007) using a

four-point rating scale ranging from 1 = "Not at all true" 4 = "Exactly true". The questionnaires also had 13 items measuring the self-efficacy regarding overall beliefs about exercising in general and about using sport and exercise technology in training. The questions had a seven-point Likert scale ranging from 1 = "strongly disagree" to 7 = "strongly agree". These items were not, as such, intended as measures of specific broader constructs related to self-efficacy, although some of the items shared common themes. Therefore, the responses were examined on the item level instead of looking at them on the construct level. In addition, the survey questionnaire contained five items measuring the attitude towards digital coaching by using a seven-point semantic differential scale. In addition, the surveys contained five items measuring the attitude towards digital coaching by using a seven-point semantic differential scale. In all of the questions in the questionnaire the order of the items was randomized for each participant. Missing values were also possible since responding to the items was non-mandatory.

The participants' ages in the beginning of the study ranged from 20 to 61 years. Information was collected about the participants' physical activity by using a scale based on the Finnish National Sport Survey (FNSS) (Finnish Sports Federation, 2011), which consisted of seven categories. The categories in the order from the most active to the least active were competition athletes, fitness athletes, fitness participants, physically active for health, active in commuting and non-exercise, occasionally active, and inactive or sedentary. Table 1 reports the descriptive statistics of the sample.

	Whole sample (N = 59)		**Intervention group (N = 30)**		**Control group (N = 29)**	
Gender						
Male	17	28.8	10	66.7	7	24.1
Female	42	71.2	20	33.3	22	75.9
Age						
< 25 years	14	23.7	8	26.7	6	20.1
25–30 years	18	30.5	8	26.7	10	34.5
31–35 years	11	18.6	6	20.0	5	17.2
36–40 years	7	11.9	5	16.7	2	6.9
40< years	10	16.9	3	10.0	7	24.1
Degree under study						
Bachelor's degree	16	27.1	8	26.7	8	27.6
Master's degree	39	66.1	20	66.7	19	65.5
Doctoral degree	4	6.8	2	6.7	2	6.9
Study mode						
full-time student	40	67.8	21	70.0	19	65.5
part-time student	15	25.4	7	23.3	8	27.6
other	4	6.8	2	6.7	2	6.9
Physical activity						
Fitness participants	8	13.6	0	0	8	27.6
Physically active for health	8	13.6	4	13.3	4	13.8
Active in commuting and non-exercise	24	40.7	17	56.7	7	24.1
Occasionally active	19	32.2	9	30.0	9	31.0

Sedentary	2	3.4	1	3.3	1	3.4

Table 1. Descriptive statistics of the whole sample and the two sub-samples.

The collected data was analyzed with the IBM SPSS Statistics 24 software. Because of the non-normal distributions in some of the items and small sample size and, the statistical significance of the changes between the measurements were tested by using the non-parametric Wilcoxon (1945) signed-rank test instead of the parametric Student's paired-samples t-test. We used $p < 0.05$ as a threshold of statistical significance. The potential missing values were handled by excluding the responses of a particular participant to a particular item if he or she had not responded it in all the three surveys. That means that the exact number of respondents (N) may slightly vary per each item.

4 Results

The results are presented in three sub-sections, of which the first concentrates on the overall exercise self-efficacy. The second part focuses on self-efficacy related to improving physical activity and the perceptions about sport and wellness technology related to training. The third section focuses on the attitude about digital coaching. For each item, we report the results of the intervention group (in grey) and the results of the control group (in white) on separate rows. The reported results include the number of respondents (N), the mean and the standard deviation (SD) of the measurements at each of the three time-points, and the p-values of the Wilcoxon signed-rank tests that were used to examine the statistical significance of the change in mean between the first measurement and the second measurement as well as between the first measurement and the third measurement. We have also bolded the changes that are statistically significant at the level of $p < 0.05$.

4.1 Exercise Self-efficacy

Exercise self-efficacy was measured by using the Exercise self-efficacy scale by Kroll et al. (2007). The scale included 10 questions regarding personal abilities in performing physical activity which are presented in the table 2 below. As can be seen from the results the intervention group experienced statistically significant positive results related to many of the questions. This increased self-efficacy was seen for example in finding means to be physically active, in overcoming barriers related to exercising, being able to exercise when feeling depressed, being physically active without a support from friend family or trainer, and being able to continue physical activity after an inactive season. However, the control group experienced a decrease in self-efficacy in being able to meet the set exercise goals and in overcoming possible barriers. Whereas the intervention group also felt more confident in being motivated to exercise even if they were tired, the control group felt less confident about it. It is worth noting that most of the statistically significant changes occurred not within the first half of the study but only when comparing the change throughout the entire intervention.

Statement	**N**	**Time 1**		**Time 2**		**Time 3**		**p (1 vs. 2)**	**p (1 vs. 3)**
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**		
	30	3.3	0.7	3.3	0.8	3.5	0.8	1.000	0.275

I can overcome barriers and challenges with regard to physical activity and exercise if I try hard enough	28	3.6	0.6	3.4	0.8	3.4	0.7	0.083	0.334
I can find means and ways to be physically active and exercise	30	2.6	0.8	2.6	0.9	3.2	0.8	1.000	**0.005**
	29	3.0	0.7	3.0	0.8	3.2	0.8	0.819	0.152
I can accomplish my physical activity and exercise goals that I set	30	2.5	0.8	2.6	0.9	2.6	0.9	0.532	0.449
	28	2.3	0.8	2.5	0.8	2.8	0.8	0.052	**0.001**
When I am confronted with a barrier to physical activity or exercise I can find several solutions to overcome this barrier	30	2.4	0.8	2.6	0.9	2.8	0.9	0.130	**0.022**
	27	2.4	0.8	2.5	0.8	2.8	0.7	0.819	**0.025**
I can be physically active or exercise even when I am tired	30	2.1	0.7	2.4	0.9	2.4	1.0	**0.039**	**0.025**
	28	2.6	1.0	2.2	0.7	2.4	0.8	**0.014**	0.251
I can be physically active or exercise even when I am feeling depressed	27	2.3	0.9	2.4	0.9	2.7	0.9	0.384	**0.022**
	23	2.3	0.9	2.4	0.9	2.7	1.0	0.527	0.054
I can be physically active or exercise even without the support of my family or friends	30	3.2	0.9	3.1	1.0	3.6	0.8	0.377	**0.035**
	26	3.3	0.8	3.2	0.9	3.4	0.6	0.248	0.642
I can be physically active or exercise without the help of a therapist or trainer	30	2.7	0.9	2.8	0.9	3.3	0.8	0.674	**0.004**
	27	3.4	0.7	3.3	0.5	3.6	0.6	0.366	0.356
I can motivate myself to start being physically active or exercising again after I've stopped for a while	29	2.4	0.8	2.7	0.7	3.0	0.8	0.077	**0.003**
	28	2.6	0.9	2.7	0.9	2.8	0.8	0.415	0.071
I can be physically active or exercise even if I had no access to a gym, exercise, training, or rehabilitation facility	30	3.2	0.9	3.2	1.0	3.2	1.0	0.523	0.564
	26	3.1	1.0	3.0	0.9	3.1	1.0	0.623	1.000

Table 2. Changes in exercise self-efficacy

4.2 Self-efficacy Related to Improving Fitness and sport and exercise technology

The self-efficacy regarding participant's opinions about exercising and improving fitness in general was measured by a total of 13 items. Of them, six items concentrated on the role of sport and wellness technology regarding exercising and improving physical fitness. The results of these measurements are reported in Table 3.

As can be seen, statistically significant changes between the measurements were found in several items. First, the intervention group found it easier after the intervention to analyze their own aerobic fitness as well as felt more confident on knowing how to improve it. After the intervention the intervention group also felt on average more confident in being able to create for themselves an exercise program and were more confident in training independently without any guidance or coaching. Both groups found it easier in the end of the intervention to find out how to improve one's fitness. Secondly, when it comes to the beliefs about sport and exercise technology, the intervention group participants experienced a statistically significant decrease in their belief in reliability and accuracy of sport and wellness technology devices whereas the control group did not have any significant changes in their beliefs. The intervention group also

had a statistically significant decrease in their beliefs regarding the usefulness of the data received from the technology and its ability to help in improving fitness. As can be seen form the results, this decrease took place already in the first five-week period during the intervention. Regardless of the decrease the average opinions regarding the above-mentioned statements still stayed more positive than negative.

Statement	N	Time 1		Time 2		Time 3		p (1 vs. 2)	p (1 vs. 3)
		Mean	SD	Mean	SD	Mean	SD		
I know how to create myself an exercising program	30	3.0	1.4	3.5	1.6	3.9	1.8	0.092	**0.002**
	29	3.8	1.7	4.0	1.6	4.0	1.6	0.444	0.463
I need help in creating myself a suitable exercising program	30	5.9	1.4	5.0	1.7	4.6	1.6	**0.002**	**< 0.001**
	28	4.6	2.0	4.4	1.5	4.2	1.7	0.591	**0.040**
I am able to train independently without any guidance or coaching	29	3.8	1.6	4.7	1.4	4.9	1.8	**0.003**	**0.001**
	29	5.2	1.4	5.3	1.4	5.4	1.3	0.505	0.313
Sport and wellness technology has an important role in my exercising	30	3.5	1.8	3.9	1.8	3.6	2.0	0.365	0.793
	29	3.3	2.1	3.1	1.8	3.0	1.6	0.473	0.182
Sport and wellness technology provides me with important information that I can use in my exercising	30	5.7	1.2	4.9	1.5	4.9	1.7	**0.027**	0.076
	26	5.4	1.1	5.0	1.5	5.2	1.3	0.310	0.334
I am able to improve my fitness with the help of sport and wellness technology	28	5.4	1.1	4.9	1.6	4.5	1.6	0.103	**0.004**
	24	4.8	1.6	4.8	1.1	4.6	1.5	0.672	0.659
I believe that sport and wellness technology provides me with reliable information regarding my own exercising	30	6.1	0.7	5.0	1.4	5.0	1.6	**0.001**	**0.001**
	28	5.2	1.4	5.3	1.4	5.5	1.2	0.542	0.187
I believe that sport and wellness technology provides me with accurate information regarding my own exercising	30	6.0	0.9	5.0	1.6	4.9	1.6	**0.002**	**0.002**
	27	5.6	1.3	5.1	1.4	5.3	1.1	0.106	0.425
I believe that sport and wellness technology provides me with truthful information regarding my own exercising	30	6.1	0.8	5.0	1.5	5.1	1.5	**0.001**	**0.003**
	29	5.2	1.6	52	1.4	52	1.2	0.814	0.869
It is hard for me to find out how to improve my aerobic fitness	29	3.2	1.9	2.7	1.7	2.4	1.6	0.123	**0.027**
	28	3.0	1.9	2.6	1.5	2.3	1.2	0.300	**0.022**
I do not know how to increase the level of my aerobic fitness	30	2.9	1.5	2.5	1.6	2.4	1.5	0.174	0.085
	28	2.3	1.7	2.2	1.3	2.3	1.2	0.912	0.831
It is hard for me to analyze my aerobic fitness	30	4.7	2.0	4.2	2.0	3.8	1.9	0.316	**0.005**
	28	3.9	1.8	3.8	1.7	3.9	1.4	1.000	1.000
I know how to improve my aerobic fitness	29	4.3	1.8	5.0	1.6	5.0	1.6	**0.047**	0.058
	29	5.6	1.5	5.3	1.3	5.3	1.3	0.330	0.469

Table 3. Changes in self-efficacy related to improving fitness and sport and wellness technology

4.3 Attitude towards digital coaching

The attitude towards digital coaching was measured by five items. These items concentrated on the overall attitude (bad vs. good) as well as on the experimental (unpleasant vs. pleasant and uncomfortable vs. comfortable) and the instrumental (useless vs. useful and foolish vs. sensible) aspects of attitudinal evaluations. The results of these measurements are reported in Table 4 below. When looking at the results it can be seen that the attitude in the intervention group experienced a statistically significant decrease when comparing the time throughout the entire intervention period. This change was not statistically lower when compared the results within the first five weeks, meaning that the more significant changes in attitude took place in the second five-week part of the intervention. There was no statistically significant change in the control group.

Statement	N	Time 1		Time 2		Time 3		p (1 vs. 2)	p (1 vs. 3)
		Mean	SD	Mean	SD	Mean	SD		
The thought of using a digital coach as a support for my training sounds: bad vs. good	30	6.4	0.8	5.9	1.1	5.2	1.7	0.078	**0.003**
	29	5.3	1.3	5.4	1.2	5.3	1.5	0.591	0.791
The thought of using a digital coach as a support for my training sounds: useless vs. useful	30	6.3	0.8	6.0	1.0	4.8	1.9	0.192	**0.002**
	29	5.5	1.5	5.6	1.4	5.4	1.5	0.630	0.783
The thought of using a digital coach as a support for my training sounds: foolish vs. sensible	30	6.4	0.8	6.2	1.0	5.5	1.5	0.361	**0.007**
	29	5.2	1.5	5.5	0.9	5.3	1.4	0.278	0.741
The thought of using a digital coach as a support for my training sounds: unpleasant vs. pleasant	30	5.9	1.1	5.6	1.3	5.1	1.7	0.398	0.053
	29	4.9	1.4	5.1	1.5	5.2	1.4	0.209	0.230
The thought of using a digital coach as a support for my training sounds: uncomfortable vs. comfortable	30	6.2	0.8	5.8	1.2	4.9	1.6	0.068	**0.002**
	29	5.1	1.2	5.2	1.3	5.1	1.5	0.519	0.957

Table 4. Changes in attitude towards digital coach

5 Discussion

This study examined the changes in self-efficacy regarding physical activity and exercising within university students who were physically inactive and who felt they needed to increase their exercise level. The main research question of the study was: Can the use of a digital coach affect self-efficacy related to physical activity and exercising within physically inactive people? The study was conducted as an intervention study which contained 59 volunteer participants divided into intervention and control group. During the 10-week intervention the intervention group participants used a sport and wellness technology digital coach. The measures used in the study were based on psychological measurement of self-efficacy that consisted of three online surveys regarding participants' perceptions about their own skills and confidence and also about their attitude towards digital coaching.

According to the results, digital coaching has some potential in affecting the self-efficacy of its users. The intervention group participants seemed more confident at the end of the study in their abilities to overcome obstacles related to exercising as well as felt more confident in their ability to train independently without support from friends, family, or a trainer. In general, the self-efficacy towards exercising had increased, whereas the control group did not experience a significant increase in their self-efficacy.

Moreover, it also seemed that after the intervention, the intervention group participants felt more confident about their ability to analyze their own physical activity level, knowing how to improve their fitness, and on their skills to create themselves a training program. However, the results also showed that the intervention group experienced a decrease in trust towards the data they received from their digital coach. This was also apparent when measuring their attitude towards digital coaching. Control group participants did not have statistically significant changes in their attitude towards digital coaching nor in their trust towards sport and wellness technology data. Regardless of the decrease in all levels of attitude (experimental, instrumental, and overall) within the intervention group, the average attitude towards digital coaching still remained positive after the intervention in both groups.

From a theoretical perspective, the study suggests that digital coaching has potential in increasing self-efficacy related to physical activity and exercising. The results support the findings of previous studies (e.g., Kettunen et al., 2018, Feltz et al., 1988) which highlighted the role of performance-based information affecting self-efficacy positively. However, as most of the effects only occurred in the second half of the study, it indicates that it might take a while for the users to learn to train with a digital coach and to understand its potential for their own personal use and benefit. Further, it may be that 5 weeks is too short a time for significant behavioral change to occur while 10 weeks starts to be long enough for changes to be realized. Ensuring sufficient time for behavior change to occur may be an important consideration for both practitioners and researchers in future studies and physical activity interventions.

From a practical perspective, the results imply that when using digital coaches as part of interventions to promote physical activity, the length of the intervention should be long enough. And, when conducting research with such interventions, it would be good to have not just the start and end surveys but also surveys in the middle or at varied time points during the intervention period.

The finding that the trust towards the digital coach decreased during the intervention period sends a message to the developers of such solutions. They should pay increasing attention to their users' perceptions of the data and focus on improving the quality and trustworthiness of the presented data and subsequent coaching programs. And of course, base their suggestions on scientific research.

To summarize the contribution, from a theoretical perspective this study increases the understanding on how digital coaching solutions can influence physical activity related self-efficacy. From a practical standpoint, the presented practical implications can be utilized both within the sport and wellness technology industry and the society when working with digital coaching or different physical activity interventions.

6 Limitations and Future Research

The main notable limitation of this study is its relatively small sample size consisting of 59 participants divided into two sub groups. Regardless of this limitation, statistically significant

differences were found in both groups. However, in the future it is worth doing a similar study with a larger group of participants. Having a large number of female participants compared to male participants could also be seen as a limitation.
As this study was combining exercise psychological perspective and digital coaching into physical activity intervention within physically inactive people, future studies could focus on using different types of digital coaches or different target groups and studying the effects within this setting.

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