Master's thesis

NTNU
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Faculty of Social and Educational Sciences
Department of Sociology and Political Science

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The relationship between wearable activity trackers, psychological needs, autonomous motivation and physical activity levels among the adult population

Master's thesis in Idrettsvitenskap
Supervisor: Ingar Mehus
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Abstract

Physical inactivity is a considerable problem worldwide, causing major health problems for the human population. Physical activity (PA) is associated with being essential for decreasing the risk of obesity, diabetes, and cardiovascular diseases, and therefore, increasing PA participation in the population is important. Motivation is considered crucial for PA participation, with autonomous motivation seen as the optimal. A strategy used to increase PA in the last decade is wearable activity trackers (WATs), which is seen as a motivational tool to increase PA participation. Therefore, this thesis aims to examine the relationship between WATs use, psychological needs, autonomous motivation, and PA levels.

The study was conducted using a cross-sectional self-reported survey, which included a sample size of 217 participants, comprising 152 females and 65 males between the ages of 18 and 64. The study found that WATs use has no correlation with PA but is positively correlated with competence satisfaction and autonomous motivation. At the same time, negative correlations have been found between WATs use, autonomy frustration and competence frustration. PA has shown positive correlations with competence satisfaction and autonomy satisfaction, and with autonomous motivation. The regression analysis showed that relatedness satisfaction and autonomous motivation were PA's most significant explanatory factors, together with gender.

In summary, the findings indicate that autonomous motivation and relatedness satisfaction are the most important motivational factors for PA participation in the adult population for this thesis. The results indicate that individuals who utilise WATs and those who do not utilise WATs can achieve autonomous motivation, fulfil the three basic psychological needs, and reach high PA levels, which may suggest that individuals are motivated differently. Therefore, individual differences should be taken into consideration in relation to PA participation and WATs use. Further studies should examine the relationship between WAT use and PA participation and how individual differences impact motivation.

Sammendrag

Mangel på fysisk aktivitet er et stort problem verden over, noe som skaper store helseutfordringer. Fysisk aktivitet er en viktig bidragsyter til å redusere risikoen for fedme, diabetes og hjerte- og karsykdommer, og derfor er det viktig å øke befolkningens fysiske aktivitetsnivå. Motivasjon er sett på som en viktig faktor for deltakelse i fysisk aktivitet der indre motivasjon er sett på som en av de viktigere motivasjonskomponentene. Aktivitetsmålere har blitt sett på som en del av løsningen på mangelen på fysisk aktivitet ved å kunne bidra til å øke motivasjonen til brukere. Derfor er hensikten til studien å undersøke forholdet mellom bruken av aktivitetsmålere, de psykologiske behovene, selvbestemt motivasjon og fysisk aktivitetsnivå i den voksne befolkningen.

Studien har brukt en nettbasert undersøkelse til å samle inn data, og inkluderer 217 deltakere hvor 152 er kvinner og 64 er menn i alderen 18 til 64 år. Studiens resultater viser at bruken av aktivitetsmålere ikke har noe sammenheng med fysisk aktivitet, derav viser bruk av aktivitetsmåler en positiv korrelasjon med tilfredsstillelse av kompetanse og selvbestemt motivasjon. Samtidig er det funnet negative sammenhenger mellom bruken av aktivitetsmåler, frustrasjon av autonomi og kompetanse. Fysisk aktivitet har vist positive sammenhenger med tilfredsstillelse av kompetanse og autonomi og selvbestemt motivasjon. Regresjonsanalysen viste at tilfredsstillelse av tilhørighet og selvbestemt motivasjon var de viktigste forklaringsfaktorene for fysisk aktivitet i denne studien, sammen med kjønn.

Oppsummert, indikerer funnen at selvbestemt motivasjon og tilfredsstillelse av tilhørighet er de viktigste motivasjonsfaktorene for fysisk aktivitetsdeltakelse for voksne i denne studien. Midlertidig ble bruk av aktivitetsmåler funnet å ikke påvirke deltakelse i fysisk aktivitet. I forhold til at deltakerne i studien har høy selvbestemt motivasjon og tilfredsstillelse av behovene indikerer det at individer som bruker aktivitetsmåler og individer som ikke bruker aktivitetsmåler kan begge oppnå selvbestemt motivasjon, tilfredsstillelse av de grunnleggende behovene og oppfylle anbefalingene for fysisk aktivitet, noe som kan tyde på at individer blir motivert for fysisk aktivitet av forskjellige grunner. Ytterligere studier bør undersøke mer omfattende hvordan individuelle forskjeller kan på virke motivasjon og fysisk aktivitet.

Preface

This thesis marks the end of a two-year master`s study in sports science at NTNU. These two years have been interesting and challenging. I have taken part in an interesting and exciting study, and I have been able to meet many great people along the way.

Motivation and physical activity has been subjects that has interested me during both my bachelor`s degree in sport and exercise science and the current master`s degree. The importance of physical activity and the understanding of motivation, which is fundamental to everything humans do, has led to an interest in how we can motivate people to be more active. As well as the huge increase in wearable activity trackers around me caught my interest. I was therefore interested in connecting the use of wearable activity trackers, motivational factors, and participation in physical activity.

Multiple people have contributed to completing the master's thesis, and they all deserve a thank you. First, I want to thank the individuals who participated in the study and took the time to complete the survey, as well as a fellow master's student with whom I collaborated in making the survey. I would also like to thank my supervisor, Ingar Mehus, who has taken the time to reply to all questions and challenges that have arisen along the way. Your input, professional support and comments have been crucial to reaching the goal. Thank you very much!

Finally, I would like to thank my good friends and family for all their support and joy in everyday life.

Table of content

1.0. Introduction

Physical inactivity is a major worldwide problem for human health. World Health Organisation (2023) estimates that one in four adults worldwide is not meeting the recommendation for physical activity (PA) despite the well-known knowledge of the importance of PA for physical and mental health. Physical health is found to be negatively affected by physical inactivity, such as increased risk of obesity, diabetes, cardiovascular diseases, osteoporosis, high blood pressure and cancer (World Health Organisation, 2022). Increasing PA participation at an earlier stage in adult life is essential with an increasingly increasing elderly population and an adult's prominent role in children's PA behaviour and health. Therefore, exploring solutions to increase PA participation among the adult population is important.

Recent statistics indicate that only three of ten adults in Norway meet recommended PA levels (Folkehelseinstituttet, 2023). At the same time, there is a rise in obesity and overweight among the adult population in Norway (Norsk Helseinformatikk, 2022). It is indicated that more people are overweight or obese than normal weighted people in Norway. According to these figures, a sedentary lifestyle is more prevalent than an active lifestyle. The modern lifestyle is sometimes cited as a primary factor in the massive absence of PA among people today because of the development of machines and other technological gadgets that lessen the amount of physical labour and effort required to do tasks. In addition to the negative physical effect of the lack of PA, there are also found to be adverse effects on mental health, like increased risk of depression and anxiety. At the same time, PA has been shown to reduce symptoms of depression, anxiety, and stress (Singh et al., 2023).

Indirect consequences of physical inactivity are major costs to society, like healthcare, reduced productivity, and reduced quality of life (Ding et al., 2017). Physical inactivity is thought to have cost society over USD 54 billion in 2016 (World Health Organisation, 2023). Increasing PA levels is crucial to reducing healthcare costs, increasing the number of working people, increasing the number of older adults living alone, and improving society's overall quality of life. Due to the negative effect of physical inactivity on society, the need for low-cost solutions to increase PA levels among the population is enormous.

Wearable activity trackers (WATs) can be a part of this solution to increase PA participation in the adult population. Over the past ten years, technology has had a major development, including a gained popularity for WATs use as a health-promoting tool to promote an active lifestyle (Shih et al., 2015). In 2021, two hundred thirty-two million wearable devices were shipped, with a 20% increase from 2020 (CCS Insight, 2022). The leading devices are smartwatches, with the Apple watch being shown to be the most popular, followed by Fitbit, Garmin, Polar and Xiaomi (Dehghani et al., 2018; Maher et al., 2017). Previously, these devices have been reserved for elite athletes, yet have now increased among the general population mainly because of significant interest in technology and an increased interest in collecting and analysing data about themselves. Additionally, the devices are becoming affordable, visually appealing, and user-friendly to the general population (Degroote et al., 2020; Maher et al., 2017).

Wearable activity trackers are described as either worn as a watch or clip-on commonly used on the hips, providing feedback by translating movement using accelerometers and sensors. The market has multiple types of WATs that measure and collect data differently and contain different features. The most common features are step count, distance, training load, heart rate, energy expenditure, calorie counting, sleep pattern, and stress. Shei et al. (2022) found that the most known and used features were step count and heart rate, while training load and sleep pattern were the least known features. Even though the devices have become popular among the general population as health-promoting devices, there is still considerable scepticism about the effectiveness of WATs use among scientists, medical, and the general community (Gonzales, 2017; Lieberman, 2015). Often, the scepticism is rutted in the validity and reliability of the devices. A study by Degroote et al. (2020) showed that the validity was strongest for the feature step count. Xiaomi had the highest validity, while MVPA time was weakest in all devices. In addition, in a systematic review, Evenson et al. (2015) found that the highest validity was step count, with energy expenditure and sleep having the lowest. Furthermore, step count, distance, energy expenditure and sleep had the highest reliability. Even though certain features' validity can be questionable, technology is improving rapidly regarding sensors, engineering, and algorithms (Düking et al., 2018).

Studies have indicated that WATs use can help increase PA levels and have a positive impact on exercise behaviour (Brickwood et al., 2019; Ferguson et al., 2022; Kinney et al., 2019; Li et

al., 2021; Maher et al., 2017). The devices are commonly used to promote an active lifestyle, and motivation is essential (Nüss & Li, 2021). Motivation is a collective term for factors that initiate and control human behaviour and are considered one of the most important factors associated with participation in PA (Edmunds et al., 2006). Motivation plays a significant role in how we conduct ourselves, impacting our actions in many areas, such as PA, work, leisure, exercise, and sports. Ryan and Deci (2007) describe motivation as the driving force behind any action, and making people participate in PA is only possible with the person being motivated to participate. The term motive comes from the Latin word "mover", which can be translated as movement or set in motion. Motivation can be explained by providing intensity and direction to human behaviour, including chosen actions, how persistent, how hard, and how committed people are to those actions (Biddle & Mutrie, 2008). Research on motivation in PA attempts to understand the cause of why humans are physically active or how to make people exercise. Multiple theories exist in motivation, where it is common to divide extrinsic and intrinsic motivation. Other motivational factors considered key for PA participation are autonomy, competence, and relatedness (Deci & Ryan, 2008; Ebben & Brudzynski, 2008; Patek et al., 2015).

WATs are suggested to impact different factors in motivation, and research indicates a positive correlation between WATs use and motivation for PA, leading to increased activity levels (Friel & Garber, 2020). Studies have found that WATs use can contribute to both controlled and autonomous forms of motivation (Nüss & Li, 2021). Whereas intrinsic and autonomous motivation is associated with being essential for PA participation (Edmunds et al., 2006; Teixeira et al., 2012). The devices are suggested to impact a person's motivation for PA, which can lead to promoting behaviour-change techniques like goal setting and self-monitoring (Brickwood et al., 2019; Chaddha et al., 2017).

Numerous studies have indicated that utilising WATs is a driving force for motivation in PA and can potentially increase PA levels (Ferguson et al., 2022). However, it has also been observed that this effect is temporary and gradually diminishes over time (Kerner & Goodyear, 2017). Research has demonstrated that competition, guilt, and internal pressure all contribute to short-term motivation enhancement. At the same time, research indicates that utilising WATs can make the users dependent on the device, like the WATs users do not feel like exercising or participating in PA when the device is unavailable (Attig & Franke,

2019). The research on the subject is conflicting in the evidence on the effect of WATs use on PA levels and the impact on motivation for PA (Kerner & Goodyear, 2017; Kim et al., 2018; Ferguson et al., 2022). Therefore, it is vital to conduct further research to better understand the relationship between WATs use and motivation and PA levels.

1.1. The research question

A considerable amount of research on motivation and PA is focused on what motivates humans to participate in PA and maintain the behaviour. WATs have become a possible solution to help solve the problem of increasing the PA levels in the population, considering the significant constant improvement in technology and the increased popularity of collecting data.

The primary research on WATs impact on PA and motivation is often conducted with intervention-based research where the utilisation of WATs is used in a specific setting for a specific period. Therefore, the utilisation can be "forced" for the research. However, limited research has been conducted using a cross-sectional survey study examining the impact of WATs use in a more "normal" setting in people`s daily lives. Moreover, most of the studies conducted with a cross-sectional survey are on students and less research on the adult population. In addition, most research has been conducted in other countries, with minimal research conducted in Norway. Therefore, investigating the relationship between WATs use on PA levels and the impact on motivational factors in the adult population is essential to finding solutions to the problem of physical inactivity in Norway.

The research question of this thesis aims to investigate the relationship between the use of WATs, motivation for PA and PA levels in the adult population. Based on previous research, the research question is as follows:

What is the relationship between the use of WATs, psychological needs, autonomous motivation, and PA levels in the adult population?

2.0. Theory

This chapter will present the theoretical framework used in this thesis. First, the concept of PA is explained, and then the theoretical framework of self-determined motivation is

explained with a focus on the self-determination theory, which is the utilised motivation theory in this thesis.

2.1. Physical activity

For the human body to have an optimal function, it is essential to perform PA consistently. As mentioned, only around 30% of the adult population in Norway is shown to meet the recommendations for PA (Folkehelseinstituttet, 2023). The Norwegian Directorate of Health recommends that adults between 18 and 64 are regularly physically active to maintain optimal health. The weekly recommendations are at least 150 to 300 minutes with moderate intensity, at least 75 to 150 minutes of high intensity, or a combination of the intensities with an additional two days of strength exercises a week, similar to the World Health Organisation (WHO) advise (Helsedirektoratet, 2023; World Health Organisation, 2022).

Physical activity is defined as any bodily movement carried out by the skeletal muscles which significantly increases energy consumption beyond the resting level (Folkehelseinsituttet, 2022). Being physically active raises the heart and respiratory rates, which have a positive effect over time, including a better heart, healthier muscles, and a more effective immune system (Helsedirektoratet, 2015). On the other hand, physical inactivity can increase the risk of obesity, diabetes, osteoporosis, cancer, depression, and anxiety (World Health Organisation, 2022; Warburton et al., 2006). Recent research shows that more time in low and moderate intensity is correlated with a reduced risk of early death (Ekelund et al., 2019). A standard recommendation is to walk 10,000 steps daily to maintain good physical health (Tudor-Lock et al., 2011; Wattanapisit & Thanamee, 2017). Studies have indicated that walking 10,000 steps daily could improve body composition by reducing body weight, body mass index, and hip and waist measurement. Therefore, the number of steps can indicate an individual`s physical health (Booth et al., 2014). However, more recent research has suggested that 10,000 steps daily are unnecessary for good health. A study by Paluch et al. (2021) found that walking over 7000 steps daily decreases mortality between 50 and 70 % and improves health.

The gold standard for measuring PA is with a double-labelled water method performed in a lab (Steultjens et al., 2023). However, an accelerometer is considered the more accurate

when measuring PA in a normal daily life setting. Another method is a questionnaire, deemed less costly and time-consuming to perform on a larger sample size. Multiple instruments exist for measuring PA with a questionnaire. Therefore, the International Physical Activity Questionnaire (IPAQ) was made to produce a worldwide instrument. IPAQ was developed in 1998 by a group of experts in PA and has since become the most commonly used PA instrument in questionnaires (Craig et al., 2003; Poppel et al., 2010). There are two versions of IPAQ, a long-form and a short form (IPAQ-SF), with similar validity and reliability (Craig et al., 2003).

Three central factors considered important in calculating PA are frequency, duration, and intensity. The first factor is *frequency*, which is how often the PA is conducted over a specific period. *Duration* is the time spent in PA; the last factor, *intensity*, is the load during PA (Helsedirektoratet, 2015). *Intensity* is measured as absolute intensity, energy consumption per unit of time, or relative intensity, i.e., the proportion of maximum capacity. Intensity is divided into low, moderate, and vigorous (Nerhus et al., 2011). In the literature, PA is often called MVPA (moderate-to-vigorous physical activity), a collective term for moderate-to-vigorous PA. Another essential factor for PA is the type of activity. Physical activity includes various movements such as leisure, play, football, walking, gardening, climbing, or dancing. These activities are all fundamentally different in the way the activities are executed. There is also a significant difference in the extent to which one is physically active in *frequency*, *duration* and *intensity* in the different activities (Breivik, 2013).

Commonly, PA is calculated by the metabolic equivalent (MET), which indicates the ratio between energy consumption during PA and energy consumption at rest (Ainsworth et al., 2000). Activities are listed in compendiums with values indicating this relationship (Ainsworth et al., 2000; Harell et al., 2005). For adults, one MET is defined as the energy consumption of sitting still, corresponding to 3.5 mL O2*kg-1 *min-1 or 4.2 kJ*kg-1*h-1 (Harrell et al., 2005; Pate et al., 2008). It is common to define sedentary time and time spent in light, moderate and vigorous PA with a starting point in MET values. Sedentary time is defined as activities that require <1.5 METs, light as <1.6-2.9 METs, moderate as 3-6 METs and vigorous as >6 METs (Ainsworth et al., 1999; Pate et al., 2008; Tudor-Locke et al., 2011). Sedentary time refers to activities that do not significantly increase energy expenditure

beyond resting levels, including sleeping, sitting, lying down, and watching TV. Walking slowly, sitting and writing, cooking, and washing dishes are classified as light PA (Pate et al., 2008). MVPA leads to a particular increase in breathing and heart rate and is often associated with outdoor activities, fast walking, and dancing. The IPAQ-SF classify high levels of participation in PA as at least 3000 MET-minutes/week of total PA or 1500 MET-minutes/week of vigorous PA, moderate levels of participation as total PA of at least 600 MET-minutes/week or three or more days of at least 20 minutes of vigorous PA or five or more days of moderate-intensity for at least 30 minutes per day, and low levels of participation means not meeting the criteria for either high or moderate levels of PA (International Physical Activity Questionnaire Group, 2005).

Factors often associated with PA levels include gender, age, and education (McCarthy & Warne, 2022; Westerterp, 2018; Ma et al., 2016). Males are often found to be more active than females (Azevedo et al., 2007; McCarthy & Warne, 2022). A survey of the PA levels of adults in Norway found that males had higher PA levels than females and that more males would satisfy the recommendations for PA (Folkehelseinstituttet, 2022). However, some studies have shown females to be more active than males (Craft et al., 2016). Craft et al. (2016) also show that females report participating in PA because of weight loss and toning, while males are likelier to report enjoyment. In addition, exercise is more likely to predict quality of life for males than females.

Age is another factor which is suggested to increase with age to the reproductive age, then after 50 years decrease (Westerterp, 2018). Folkehelseinstituttet (2022) found that PA levels fall with age, especially after 65 years of age, with a reduction of 3% every year. In addition, more younger people were found to satisfy the recommendation for PA. A reason for the decrease in PA is suggested that some are because of the natural ageing process (Milanovic et al., 2013). Education is commonly found to be associated with PA (Ma et al., 2016; Folkehelseinstituttet, 2022). Higher-educated people are often more physically active than less-educated people (Ma et al., 2016). A survey on the Norwegian adult population found that PA levels increase with increases in education. The study showed a relation between education level and PA levels and shows that the people who satisfy the minimum recommendations increase with increased education levels. In addition, a study by Ma et al.

(2016) on the U.S. population found that 69% of people with at least a bachelor`s degree exercise regularly, and 45% of high school graduates report the same. In addition, the study indicates that higher-educated people are more active in their children`s PA. Kari et al. (2020) found that one additional year of education can lead to higher PA levels.

2.2. Self-determination theory (SDT)

SDT is one of the most common theories used in relation to PA and the selected framework for this thesis. The American motivation researchers Edward L. Deci and Richard M. Ryan (1985) developed the theory over multiple decades, originating from the 1960s. The theory is a direction within the humanistic approach to motivation. SDT is based on the reality that humans are active, to some extent, which is a counterpart to other theories of motivation. Further, SDT combines motivation and personality to explain different behaviour types by understanding the underlying motivation. Humans are assumed to have an instinct to learn and grow, where one assimilates cultural and social values (Deci & Vansteenkiste, 2004; Sheldon & Ryan, 2011). Controlled and autonomous motivation are common factors associated with motivation, where controlled motivation are external sources and autonomous motivation are internal sources of motivation. One of the primary purposes of SDT is to problematise different aspects that can inhibit and promote intrinsic motivation (Ryan & Deci, 2000; Sheldon et al., 2003).

Deci & Ryan (1985) explain that our behaviour is influenced by the desire to fulfil unmet needs. The term self-determination implies the experience of feeling options to initiate and regulate actions and is often referred to as autonomy and has its counterpart in heteronomy (Chirkov et al., 2003; Deci et al., 1989). The experience of autonomy, competence, and relatedness is based on three innate psychological needs. Satisfaction of needs can explain whether an individual experiences continuous psychological development, integrity, and well-being (Ryan & Deci, 2000). SDT consist of six micro-theories, which are Cognitive evaluation theory (CET), Organic Integration Theory (OIT), Causality Orientations theory (COT), Basic psychological needs theory (BPNT), Goal Orientation theory (GCT) and Relationships Motivation theory (RMT). The present thesis focuses on BPNT and OIT and is explained below.

2.2.1. Basic Psychological Needs Theory (BPNT)

The Basic Psychological Needs Theory is the theoretical underpinning for the research instruments utilised in this study, specifically focusing on PA. It expands the concept of the three basic needs by connecting them directly to well-being. The three basic needs are autonomy, competence, and relatedness (Deci & Ryan, 1985).

BPNT implies that all humans have innate and inherent needs, where the three basic needs are universal for every individual and found in any culture. The theory assumes that each need has an independent effect on the individual's experience of well-being and that the experience of well-being is primarily a function or a result of the need for satisfaction related to the behaviour or event. Research on BPNT shows that overall satisfaction of the needs suggests individual differences in health and well-being, as well as within the person fluctuations in well-being over time. If these three psychological needs are satisfied, the inner motivation of the individual will be promoted. Satisfaction of basic psychological needs will lead to an internalisation process in the individual, which means to actively attempt to transform controlled motivation into autonomous motivation (Gagne & Deci, 2005). Under is the three basic psychological needs described:

The first basic need is *autonomy,* which is the belief that our actions are our own rather than the result of external factors (Ryan & Deci, 2007). It is essential to feel that we are in control of our own lives and can make choices that are significant to us (Deci & Ryan, 1985). Regarding PA, we desire to select exercises and activities that we genuinely enjoy. Autonomy is an important precursor to competence and relatedness, leading to self-motivation.

The basic psychological need for *competence* has been seen as a crucial part of determining a person's ability to perform tasks of varying complexity and know what is necessary to interact with the environment (Ryan & Deci, 2017). It is a feeling of self-confidence and not limited to the execution of tasks. It also positively affects one's ability to regulate stress, maintain high self-esteem, and ensure overall well-being (Ryan & Deci, 2000). The feeling of being competent in meeting tasks and challenges is indicated to increase autonomous motivation (Deci & Ryan, 2000). Conversely, the absence of competence can lead to adverse mental health outcomes such as depression, anxiety, and low self-esteem. Therefore,

enhancing one's competence and abilities is imperative to improve mental health and overall quality of life. The need for competence is satisfied by the possibility of improving and learning. Concerning PA, *competence* can be understood in the context of knowing what to do, like how to use exercise techniques and equipment, and in the context of utilising WATs, it is necessary to understand the product and technology.

The third basic need is *relatedness,* which is about the experience of feeling that the person belongs and is experiencing having a respectful and supportive connection to people around them who matter. Experience *relatedness* means one experiencing belonging with others psychologically, in a safe environment or society. Utilising WATs to participate in PA can feel the need for relatedness by sharing and comparing data with friends and family (Bice et al., 2016; He et al., 2013; Mekky, 2014).

Basic psychological needs are seen as fundamental to mediating intrinsic and extrinsic motivation. High satisfaction levels in autonomy, competence and relatedness increase autonomous motivation (Deci & Ryan, 1985). This indicates that individuals who experience satisfaction in autonomy, competence and relatedness have a higher probability of participating in PA since the individual has higher autonomous motivation (Vlachopoulos & Michailidou, 2006; Wilson et al., 2008).

2.2.2. Organic Integration Theory (OIT)

Organic Integration Theory (OIT) is the second mini-theory utilised in the thesis and regards the internalisation process of different external motives (Figure 1). The theory aims to explain how behaviour initially motivated by external factors can be internalised and become internally motivated through an internalisation process. The internalisation process is central to OIT, where intrinsic motivation is considered the core of the process (Ryan & Deci, 2000). OIT suggests that internalisation is facilitated by contextual support for the three basic psychological needs: autonomy, competence, and relatedness. Internalisation can be divided into two processes: introjection, which means taking in a value and integration, which means transforming the value into one`s own (Deci et al., 1994). This process involves adopting external values and behaviours that lend a sense of self-determination to our actions (Ryan & Deci, 2000). Through this mechanism, we can regulate

our beliefs, attitudes, and personal values, ultimately integrating them into our identity. This theory illuminates how various actions and values shape and define individuals.

The theoretical model suggests that motivation can be understood as a spectrum that ranges from amotivation, which represents a complete lack of motivation, to intrinsic motivation, which is characterised by autonomous behaviour driven by internal factors (Deci & Ryan, 2002). This model also includes four different extrinsic motivation regulations that fall between amotivation and intrinsic motivation: extrinsic regulation, introjected regulation, identified regulation, and integrated regulation. Each regulation represents different levels of extrinsic motivation and can impact the level of self-determination and autonomy that individuals experience (Deci & Ryan, 2002).

External regulation is a form of extrinsic motivation in which external factors influence an individual's behaviour. This type of motivation is characterised by the individual's performance of an activity due to external factors, such as a reward or punishment, controlled by someone else. As there is no internalisation of the activity in this type of regulation, it is considered the most controlled form of extrinsic motivation. External regulations regarding participating in PA are, for example, to appease external demands like family members or friends telling them to participate in PA. WATs can be the external demand, demanding the person to move and do more PA through the device.

Introjection is a complex behaviour closely tied to an individual's sense of self. Internal pressures often drive it to avoid negative emotions such as guilt, anxiety, or a bad conscience. While the actions may be based on internal expectations, the behaviour is characterised by external control, as the individual does not have a personal desire to engage in the activity. This behaviour can strengthen one's sense of self or ego but remains externally motivated, as it is not self-determined. For example, it can be the feeling of guilt for not participating in PA and thinking other people look down on them if they do not participate.

The following form of regulation of external motivation is *Identified regulation.* This regulation is a more self-determined form of motivation than the first two. Identified regulation is characterised by the individual's understanding that the behaviour is essential.

However, it could be more interesting, engaging or in line with the individual's goals. However, the individual has accepted the values behind the regulation. Therefore, there is a greater agreement between external regulation and the person's inner values. This makes the behaviour feel less imposed and more autonomous than the previous forms of regulations—the individual experiences freedom of choice (Gagne & Deci, 2005). The person is driven by a reason important to the person regarding PA: for example, that the person knows participating keeps them healthy, better has mental health and improves mood.

Integrated regulation is the most advanced form of external motivation with development potential. The regulation means that the individual has accepted the regulation and accepted the values of their own. A match exists between the individual's goals, thoughts, values, and fields of interest. The person will feel that the behaviour is voluntary and based on autonomy (Deci & Ryan, 2000). This is the form of extrinsic motivation closest to intrinsic motivation. Actions at this level differ from internally motivated actions because the person may not be personally interested in the activity.
Although they will ultimately govern the action here, it is still instrumental because the individual is not driven by personal interest and involvement in the activity. However, it is the importance of reaching the goal itself that constitutes the drive. Integrated regulation will, therefore, remain externally motivated behaviour in this context (Gagne & Deci, 2005). For example, there are integrated regulations when a person participates in PA because it is essential for them.

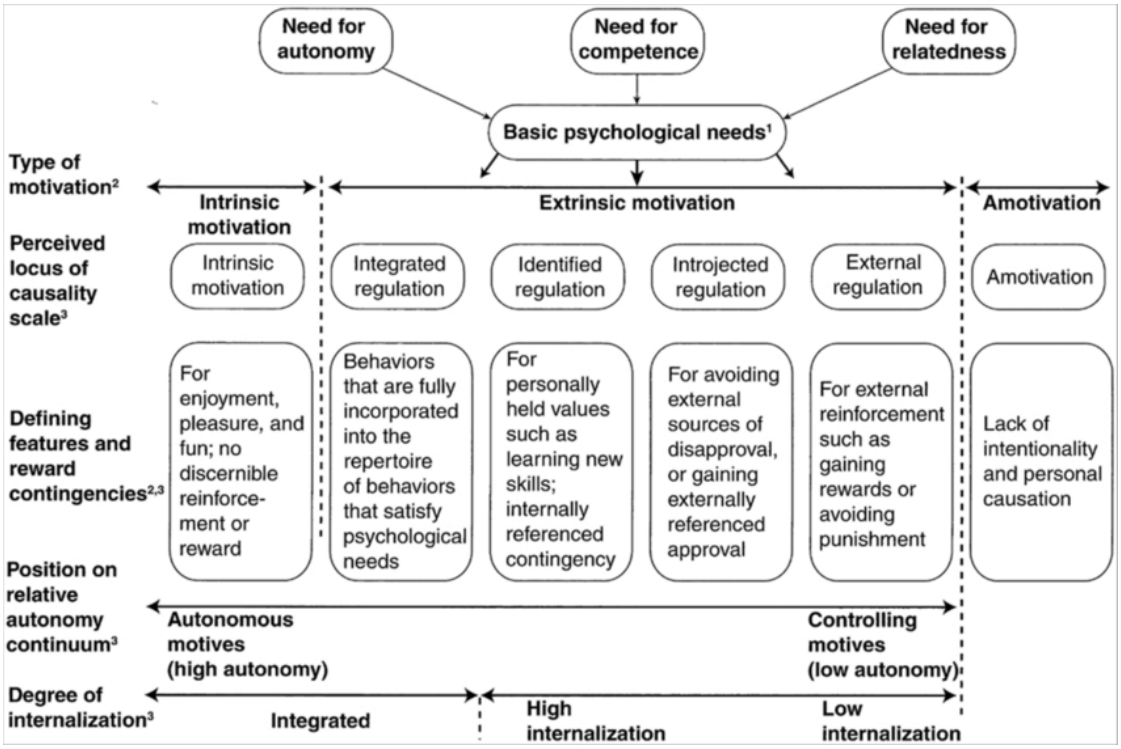

Figure 1: The motivation regulation from external to internal motivation (Ryan & Deci, 2007, s.8).

Different motivational behaviours are utilised in different settings. Within SDT research, an important part is to investigate how different motivational regulations predict behaviour in different individuals. In relation to PA, autonomous motivation regulations are the most positively correlated and considered crucial for maintaining PA and exercise behaviours (Teixeira et al., 2012). Identified regulation and intrinsic motivation are associated with PA participation (Wilson et al., 2004). In addition, identified regulation and intrinsic motivation are associated with the three basic psychological needs, especially autonomy and competence (Wilson et al., 2003). Intrinsic motivation is often called autonomous motivation, and extrinsic motivation is often called controlled motivation.

3.0. Previous research

In this chapter, research examining the self-determination theory in the context of PA and WATs use in relation to PA is explained.

3.1. Self-determination theory on PA

Extensive research has explored the link between self-determination and PA, investigating various motivational factors that influence participation in PA (Teixeira et al., 2012; Nogg et

al., 2021). Within self-determination, autonomous motivation has been the most associated motivation in relation to PA, where the three basic psychological needs are suggested to support autonomous motivation. One comprehensive literature review by Teixeira et al. (2012) analysed 66 empirical studies, including prospective, cross-sectional, and experimental research, to examine the relationship between SDT and PA. The review found that satisfying the three basic psychological needs -autonomy, competence, and relatedness – is crucial for predicting PA and exercise participation, with competence being the most significant need. Additionally, the study found that autonomous motivation positively correlates with PA and exercise, indicating that autonomous motivation is critical in maintaining PA and exercise behaviour. In addition, a more recent review by Teixeira et al. (2018) found a correlation between autonomous motivation and positive effects in exercise settings, as well as better emotional response to PA. Moreover, the review showed that all the basic psychological needs were found to correlate with PA and positively affect PA levels. These reviews indicate that the basic psychological needs and autonomous forms of motivation are related to PA participation.

A recent study conducted on adolescents in the U.S. found a positive correlation between PA and external regulation, introjected regulation, identified regulation, and intrinsic motivation (Nogg et al., 2021). Ntoumanis et al. (2021), based on SDT, showed that interventions based on SDT led to an increased need for support and autonomous motivation, resulting in positive changes in health outcomes. In addition, the study showed no significant effect on controlled motivation and motivation. A study by Shen et al. (2019) on college women highlighted the importance of developing self-determination for being physically active and having a better quality of life. The study identified four cluster profiles, which were low self-determination/high control, low combination, high combination, and high self-determination/low control.

Research has shown that individuals who report satisfaction in the three Basic Psychological Needs Scale (BPNS; Deci & Ryan, 2000) – autonomy, competence, and relatedness - tend to display heightened levels of intrinsic motivation, leading to greater self-determination (Deci & Ryan, 1985; Vergara & Valle, 2021). Specifically, autonomy is crucial when engaging in PA that aligns with personal interests and preferences (Deci & Ryan, 2008). It is essential to recognise and explore new activities, even if they may have been previously dismissed as

uninteresting. Autonomy is particularly pivotal in exercise contexts, as it plays a fundamental role in motivational processes and predicting exercise behaviour (Barbeau et al., 2010; Gunnell et al., 2014). Studies have also shown that competence is a major predictor of engagement and increased activity levels (Gonzàlez-Cutre & Sicilia, 2012; Patek et al., 2015).

Within the three basic psychological needs, relatedness is often associated with being the least critical need for participating in PA. However, engaging in group exercises and having a training partner can significantly enhance motivation for PA among young individuals, according to research (Ebben & Brudzynski, 2008). While relatedness is considered the less essential need for participation in PA and exercise, social interaction during PA motivates some people. In contrast, others prioritise the convenience of self-directed exercise in terms of timing and location. Optimal training conditions and facilities have also been shown to sustain motivation levels. Lastly, ease of access to exercise facilities, including proximity to home and low barriers to entry, can foster a more active lifestyle.

These results indicate that interventions and tools to increase people's feeling of autonomy and competence are essential to increasing PA levels. While also engaging for the importance of the social around PA and exercise, remember the individual differences among the needs. A study by Withall et al. (2011) showed that physically inactive people felt the need for support from others, competence, and self-esteem to consider being physically active. At the same time, physically active people showed a significant number of social interactions with others, interest, and happiness through different forms of PA. This suggests that less active individuals may require greater social support to engage in PA, while those with an active lifestyle may need less social support. These results could be attributed to the fact that individuals leading a sedentary lifestyle face more barriers to participating in PA, and hence, social support plays a more significant role in motivation.

3.2. WATs, motivation, and physical activity

An expanded body of literature has emerged demonstrating the potential benefits of WATs use in promoting PA among individuals of all ages in the population. According to the comprehensive review conducted by Brickwood et al. (2019), WATs have been found to significantly increase daily steps, MVPA, and energy expenditure among users. Other systematic reviews conducted by Ferguson et al. (2022) and Li et al. (2021) further support the positive correlation between WATs use and increased PA levels. These reviews suggest

that WATs can effectively increase step count, walking, MVPA and total PA, which are important indicators of physical fitness. A study by Bayerle et al. (2022) highlights the positive outcomes of a 6-month intervention program for individuals diagnosed with metabolic syndrome in Germany. The participants showed significant improvements in physical and mental well-being, including a notable increase in relative exercise capacity and a decrease in anxiety and depression severity. In addition, a recent study found that WATs effectively increase walking MET-minutes/week in middle-aged adults. These results point to the potential of WATs in promoting PA and enhancing the well-being of adults.

On the other hand, some studies have reported mixed findings regarding the effectiveness of WATs in promoting PA. For instance, a study by Kim et al. (2018) found that college students who used WATs increased in sedentary time compared to the control group, with no notable differences observed in PA levels. These results indicate that while WATs may help users track their PA, they do not necessarily lead to increased PA levels. Similarly, a study by Yen et al. (2022) found no significant differences in walking, MVPA, total PA, sedentary time, or sleep quality among those who used WATs compared to non-users of WATs. These findings suggest that while WATs may serve as a helpful tool for monitoring PA, they may not be effective in promoting actual increases in PA levels. These results may indicate that other factors, such as motivation, affect PA levels.

There is conflicting research on the impact of WATs on PA, the basic psychological needs and OIT regulations. However, studies have shown that using WATs can positively impact an individual`s motivation, increasing PA levels. The devices are suggested to affect both controlled and autonomous motivation, as Nüss & Li (2021) found that current users of WATs had higher controlled and autonomous motivation than previous users. While Friel & Garber (2020) found a correlation between the different regulations in OIT and the use of WATs, Black & Brunet (2021) found no significant difference between the regulations and the use of WATs. Friel & Garber (2020) have found that all regulations introjected, identified, integrated and intrinsic were positively correlated with PA, while amotivation and external regulation were negatively correlated. The findings showed that identified regulations were the most strongly supported regulation. In addition, Friel & Garber (2020) have highlighted the importance of integrated regulations in promoting PA. Furthermore, the findings showed

a connection between high levels of introjected regulations and greater PA levels, suggesting that those with an inherent desire for PA tend to have greater PA levels.

WATs are suggested to impact basic psychological needs, which can then lead to autonomous motivation. Providing users with various options and personalised recommendations can encourage people to increase PA by affecting the three basic psychological needs. Additionally, WATs can be tailored to match users` skill levels and gradually introduce more challenging targets, enhancing the feeling of autonomy and competence. A recent study by Black & Brunet (2021) examined the effects of using WATs on adult women who were either overweight or obese. In addition to the study showing an increase in PA, the findings demonstrated that utilising WATs significantly positively impacted the psychological needs of autonomy, competence, and relatedness. The experimental groups that received support emails in addition to utilising WATs showed a considerable improvement in perceived competence and relatedness. However, no significant change was observed in the control and WATs-only groups. Perceived autonomy was also increased in both experimental and control groups. Therefore, this study suggests that using WATs can positively influence basic psychological needs, which is crucial in increasing adult PA levels. However, a study has found that WATs often include more controlling motivation features, such as rewards, while more autonomy or competence features are rarely included (Lyons et al., 2014). Relatedness is another psychological need that WATs can address by sharing fitness data with friends and family, where users can feel more connected and supported, motivating them to keep going (Bice et al., 2016; He et al., 2013; Mekky, 2014).

Despite the evidence indicating an impact of WATs use, research has also shown that it is temporary, and that WATs use can lead to a dependency on the device. According to Kerner & Goodyear (2017), research on adolescents has found a significant reduction in autonomous motivation and increased amotivation after wearing a device for eight weeks. On the other hand, Peng et al. (2021) found that long-term users of WATs had a more meaningful initiation of the WATs, starting with a small behaviour change goal and gradually increasing it. As well as research shows that there is a significant correlation between trust in the device and motivation, and trust and intrinsic motivation would significantly predict the desire to continue using the device (Rupp et al., 2016). In addition, research suggests that

WATs use is associated with dependence on the device to be physically active (Attig & Franke, 2019). This can impair the user`s motivation for PA when the feedback from the device is unavailable, which can also indicate that WATs use is suitable for short-term and not long-term to increase PA but rather be a tool that helps change exercise behaviour. Moreover, using WATs can lead to failure, affecting the user`s competence and causing guilt and shame (Kerner & Goodyear, 2017).

Friel & Garber (2020) found that the people who had a score over the average of introjected regulations were the cluster that had the highest MVPA scores with introjected regulations characterised as the feeling of shame and guilt. In addition, a study by Burford et al. (2021) also showed a positive perception of WATs with guilt and dependency on the device. An interest in tracking and analysing data may result in dependency, which indicates that the motivation comes from a personal interest before using the WATs. Therefore, this may indicate that PA needs intrinsic motivation before utilising WATs, not increasing motivation with the device.

3.3. Implications of previous research

The topic of the impact of using WATs in relation to PA is a complex one with conflicting research findings. While some studies suggest that WATs use can increase PA levels, others suggest no impact or even a worse effect, such as increased sedentary time (Ferguson et al., 2022; Friel & Garber, 2020; Kinney et al., 2019; Maher et al., 2017; Shih et al., 2015; Kim et al., 2018; Yen et al., 2022). However, regardless of the current research, it is important to continue exploring this topic to understand better the potential benefits and drawbacks of using WATs in relation to PA.

Research has indicated that using WATs could increase controlled and autonomous motivation for PA. Although controlled forms of motivation are suggested to be a poor type of motivation, WATs use may help this type of motivation by having features on the device that impact this type of motivation, such as rewards, goal setting or pushing the users with feedback of when to move, etc. In addition, previous findings suggest that WATs use can improve autonomous motivation by impacting the three basic psychological needs (Teixeira et al., 2012; Mekky, 2014; Bice et al., 2016; Black & Brunet, 2021). This result suggests that WATs use can help people with the satisfaction of autonomy, competence, and relatedness, which can lead to a more self-determined and autonomous motivation.

In addition, the results suggest that WATs use has a higher short-term effect on increasing PA levels, which indicates that there is a higher controlled motivation. In contrast, the device is utilised as an external motivation tool. However, the short-term effect of utilising WATs may have positive effects on people's physically and mental health. For instance, the device should be a short-term use to help people establish habits that outlast the use of the device. Previous research indicates that WATs used for intervention to lose weight can be beneficial. However, there is limited research where people are measured long after using WATs.

Therefore, it is important to continue exploring the potential benefits and drawbacks of using WATs to gain a more comprehensive understanding of whether WATs use affects PA levels and the underlying motivation reasons. By doing so, we can identify ways to optimise using WATs and other technologies to promote PA and healthy habits in the long term.

4.0. Methodology

This chapter presents and explains the methodology of the thesis regarding study design, participant selection, data collection, survey, variables, data analysis and reliability and validity.

4.1. Study design

Study design can be described as the outline of how the research answers the research questions and hypothesis. When selecting a method, it is essential to identify the knowledge on the topic and is commonly based on applied theory and previous research (Ringdal, 2014).

A quantitative research methodology was selected to answer the research problem since it is commonly used to explain behaviour. It is well-suited for many respondents and more manageable to structure the information, which can lead to a more representative selection (Jacobsen, 2005). A cross-sectional study design was selected to answer the research question of the thesis because it is one of the simplest forms of quantitative research and consists of collecting data from many different participants at one single time point. The purpose of this design is to determine the prevalence of a phenomenon or to investigate suspected causal factors and, therefore, utilised in this thesis.

4.2. Participants

In quantitative research, the purpose is to collect as much data as possible to have an extensive representative selection that can result in numerical data and be used in statistical analysis (Ringdal, 2014). When selecting participants for a study, it is essential to define the characteristics of the participants. Based on the aim of the present thesis, the participants selected are people between 18 and 64 years old. The age group between 18 and 64 years old was chosen since this age group is lacking in previous research, and the Norwegian Directorate of Health had divided the adult age group from 18 to 64 years (Helsedirektoratet, 2023). All adults in the age group selected were welcome to partake in the study. The survey was written in Norwegian, so the participants had to understand Norwegian to partake in the study. The study sample ranged in age from 18 to 64 (M=37, SD=13,5) and comprised 152 females (70.05%) and 65 males (29.95%) with a total sample size of N=217. The survey results indicate that most participants completed their education with either a college/university degree of less than four years (N=80) or a university degree of more than four years (N=79). As for the main activity of the participants, the highest number of respondents were working full-time (N=142) or being a student/military (N=48).

4.3. Data collection

An online form called "nettskjema" was utilised to create the self-reported survey utilised in this thesis. The form was chosen since it is a widely used tool for creating online surveys and is accessible through NTNU.

The survey was created in collaboration with another master's student since both collected similar data regarding PA and motivation. Collaborating was considered beneficial to increase the possibility of a larger sample size with the same sample of participants. Due to the collaboration, there are sections in the survey that are not included in this master thesis because of a lack of relevance, which includes social media, social competence and loneliness.

A supervisor reviewed the survey and underwent some adjustments after receiving feedback. Before it was released, a pilot study with one participant was conducted to ensure that respondents would understand the questions and answer them correctly. The survey was advertised on social media (e.g., Facebook and Instagram). It was distributed to various

companies in Norway by email to reach a broader spectre of adults in the population (e.g., BDO, Flytoget, primary schools, hospitals, etc.). All the respondents were given the option to sign up for a draw in a competition to win gift cards of 500kr at XXL. A reward was utilised to get more people to participate, which would give a larger sample size. The survey was open between the 27 of January and 19 of March 2023.

Conducting research gives ethical considerations to be discussed to ensure the best possible research results. Therefore, are there laws and regulations for conducting scientific research (Ringdal, 2014). All participants in the present thesis were over 18 years old, and the survey was anonymous. Therefore, there was no need to apply for approval to conduct the research. The participants were informed before the survey was conducted that at any time point during the survey, the participants could withdraw from the study. However, when clicking send, the participants would be included in the survey.

4.4. Survey

The survey was a quantitative cross-sectional study that was utilised to collect data based on a large selection of people in a limited period (Ringdal, 2014). A survey is a systematic method of collecting data with standardised questions from a larger representative sample of people, making it possible to generalise the results (Ringdal, 2014). This method can provide a standardisation in the answers that makes it possible to extract similarities and variations, which enables the generalisation of the results in the given population. Standardisation means that it is possible to carry out statistical analysis, which makes it possible to examine connections between phenomena. Cross-sectional studies have been previously used to research the relationship between SDT and PA. The results have shown that the theory is competent to be used when examining human behaviour in a PA context (Teixeira et al., 2012). However, less used in the context of WATs use in relation to PA and motivation, therefore, the present thesis utilises a self-reported cross-sectional survey which is based on previous research and theoretical framework.

In creating the survey, a theoretical framework and hypothesis are essential. In forming the questions for the survey, there are multiple elements to consider, like closed or open questions. An open question allows the respondents to write what they want and is appropriate for collecting data on attitudes and opinions on a specific topic. A closed question is a standardised question with an answer option, making it more effective to use

and more accessible to code. The present thesis primarily utilised closed questions with a couple of open questions to add additional information. Another important factor when creating a survey is the order of the questions. A survey should begin with simple questions to motivate the participants to complete the survey and be divided into sections.

The survey utilised in this thesis consists of six sections (Appendix 1). Section one includes questions about the participant's background information, which includes four questions on gender, age, education, and main activity. Gender, age, and education are utilised as independent variables in the analysis because it has shown a relationship to PA. The gender variable was recoded to values 0 and 1, with males as 0 and females as 1. The age variable is a continuous variable from 18 to 64 years old. Then education was recoded value 2 as Primary 7 to 10 years, 3 as secondary school 1-2 years, 4 as Atrium, Upper secondary school, 5 as College/University <4 years and 6 as university >4 years. Section two consists of questions about information on social media use, which is not included in this thesis.

The following sections contain a question on WATs use, which consists of eight questions like "Do you utilise a wearable activity tracker?" or "How long have you been using a wearable activity tracker?" (Appendix 1). The questions for this section are influenced by previous research (McFadden & Li, 2019). Question 17 in the survey about WATs use was utilised as an independent variable (Appendix 1). The variables are recoded to a dichotomous variable with the values 0 and 1 to separate the participants using and not using the device. The participants not using WATs have the value 0, which combines the participants that answered no and previously, while participants using WATs have the value 1. The frequency analysis conducted on the new variable showed that 35.02% (n=76) of the participants are non-users, and 64.98% (n=141) are WATs users.

The last three sections of the survey consist of established instruments to measure PA, motivation for PA and social competence and loneliness. Utilising established instruments has advantages such as making analysis and processing of data more accessible and faster to carry out. However, the disadvantage is that a common limitation for established instruments weakens the control over how the respondents interpret the questions is over-reporting, especially in PA. (Sallis & Saelens, 2000; Jacobsen, 2005). The established instruments utilised are explained below.

4.4.1. International Physical Activity Questionnaire Short-form (IPAQ-SF)

The IPAQ-SF instrument was chosen to measure PA levels because it is frequently used to measure health-beneficial PA for the adult population (Booth et al., 2003; Craig et al., 2003). As well as the short-from version was chosen since it is easier to administer and carry out with a higher sample size. The IPAQ-SF has been validated in Norwegian men and shows acceptable reliability and validity in strenuous activity and sedentary time (Kurtze et al., 2008). The instrument is well-suited to indicate PA among adults in Norway (Solberg & Anderssen, 2002).

The IPAQ-SF consists of seven questions, including two on vigorous intensity, two on moderate intensity, two on walking intensity and one on sedentary time (Appendix 1). Each intensity group has a question about the duration and frequency of PA. For example, “During the last seven days, how many days did you do vigorous physical activity like heavy lifting, digging, aerobic, or fast bicycling?” and “How much time did you usually spend doing vigorous physical activities on one of those days?” (Appendix 1). The survey is conducted in Norwegian. Therefore, a translated version by UIO (n.d.) was utilised.

A special formula is utilised when analysing the data from IPAQ-SF. The data can be calculated into either a continuous value or a categorical value. This study utilised the continuous value; therefore, the data was calculated into MET minutes/week. The formula for calculating the data to MET minutes was multiplying each intensity with a specific value. Vigorous intensity questions were calculated with a value of eight, moderate questions with a value of four and walking intensity with a value of 3.3. To calculate the total PA levels are, each intensity added together.

Total PA is the dependent variable since the research question examines the relationship between PA with WATs use and motivation. This variable is based on the IPAQ-SF instrument with the questions 28, 29, 30, 31, 32, 33 and 34 (Appendix 1). After collecting the data, it must be cleaned, which includes data collected in hours converted to minutes. If the sum of all intensities of walking, moderate and vigorous, are greater than 960 minutes (16 hours), are excluded from the analysis because it is assumed that, on average, an individual is sleeping for 8 hours per day and only 10 or more minutes of activity are included in the calculations. Therefore, values less than 10 minutes are recoded to zero. The IPAQ-SF

instrument has a truncation rule where walking, moderate and vigorous time exceeding 3 hours or 180 minutes truncated (recoded) to be equal to 180 minutes.

4.4.2. Basic Psychological Need Satisfaction and Frustration Scales (BPNSFS)

The Basic Psychological Need Satisfaction and Frustration Scales (BPNSFS; Chen et al., 2015) were utilised to assess the respondent's basic psychological needs of autonomy, competence, and relatedness in BPNT (Appendix 1). The BPNSFS was developed to capture both the satisfaction and frustration components and was initially validated in four different cultures (Chen et al., 2015). A study by Kaap-Deeder et al. (2022) showed that the instrument was reliable in Norway.

The BPNSFS consists of 24 statements that are answered on a scale from 0 to 4, where 0 is "not true at all", and 4 is "very true" (Appendix 1). Twelve claims examine the satisfaction of the basic psychological needs with four questions for each need. The remaining twelve statements examine the frustration associated with each need (Chen et al., 2015). Examples of a statement are "It is important for me to exercise" or "I exercise because it is fun".

The 24 statements are merged into six subscales: autonomy satisfaction, autonomy frustration, competence satisfaction, competence frustration, relatedness satisfaction and relatedness frustration (Appendix 1). A six-factor subscale has been validated and shown to be reliable for the Norwegian BPNSFS scale (Kaap-Deeder et al., 2022). Autonomy satisfaction consists of statements 1, 7, 13 and 19; and autonomy frustration consists of 2, 8, 14 and 20; competence satisfaction 5, 11, 17 and 23; competence frustration 6, 12, 18 and 24; relatedness satisfaction 3, 9, 15 and 21, and relatedness frustration 4, 10, 16 and 22 (Appendix 2). Before merging the statements, some statistical tests were performed.

Then Cronbach`s Alpha test was performed to test correlation, which resulted in values of 0.70 for autonomy satisfaction, 0.56 for autonomy frustration, 0.85 for competence satisfaction, 0.78 for competence frustration, 0.73 for relatedness satisfaction and 0.65 for relatedness frustration (Appendix 4). These results have shown that autonomy satisfaction, competence satisfaction, competence frustration and relatedness satisfaction are above the wanted level of 0.7 (Mehmetoglu & Jakobsen, 2017). Although autonomy frustration and relatedness frustration are slightly lower than the desired value, they are still considered relevant since the theoretical framework and previous studies support them.

4.4.3. The Behavioural Regulations in Exercise Questionnaire Three (BREQ-3)

The Behavioural Regulations in Exercise Questionnaire Three (BREQ-3) was utilised to measure exercise motivation and the different motivational regulations. The original questionnaire BREQ was first developed by Mullan et al. (1997) and measured external regulation, embodied regulation, identified regulation and internal motivation. The original BREQ-2 was developed, which added a measure of amotivation (Markland & Tobin, 2004). Since statistical analysis showed that it was difficult to distinguish between integrated and identified regulations, were these parts not included in the first two editions of BREQ. It was then added in BREQ-3, which provided good results (Wilson et al., 2006).

The instrument consists of 24 statements that measure the integration and internalisation of adult motivation for PA. Each statement measures a regulation, and the survey is therefore divided into six subscales containing four statements. These subscales each represent a motivational regulation in OIT. The statement's answer ranges from 0 to 4, where 0 is "Strongly Disagree" and four is "Strongly Agree". Examples of statements are "I don't see why I should have to exercise", "I exercise because it's fun", or "I consider exercise to be part of my identity" (Appendix 1). The 24 statements can then be calculated into mean scores for each set of items in the regulations or as a combined score, called Relative Autonomy Index (RAI). The RAI is a one-dimensional measure of self-determined motivation (Ryan & Connell, 1989). The use of RAI has often been criticised since some of the understanding of the participant's motivation with merging the regulations results in missing information. Considering the index is one-dimensional, it simplifies the data, removes some of the information, and does not bring out the multidimensional concepts, which are the characteristics of the motivation regulation from SDT (Chemolli & Gagne, 2014). However, RAI is commonly used in research since it is a valuable tool to measure the degree of self-determined motivation (Howard et al., 2020).

The indexes are then obtained by applying a weighting to each subscale and ten summing these weighted scores (Bangor University, 2023). The weighting for each subscale is -3 amotivation, -2 external regulation, -1 introjected regulation, +1 identified regulation, +2 integrated regulation and +3 intrinsic regulation. This gives the index a maximum score of 24 and a minimum score of -24. A higher score on the index represents a higher self-determined motivation for exercise.

The different motivational regulations from question 36 with amotivation represent statements 2, 8, 14 and 20; statements 6, 12, 18 and 24 external regulation; statements 4, 10, 16 and 22 introjected regulation; statements 1, 7, 13 and 19 identified regulation; statements 5, 11, 17 and 23 integrated regulation and statements 3, 9, 15 and 21 intrinsic motivation was independent variables (Appendix 1). To merge each index, a Cronbach`s Alpha test was performed. Cronbach`s alpha test showed that all subscales have high enough values to reach the requirement of 0.7 (Appendix 6).

4.5. Data analysis

The data analysis of the thesis was performed by STATA/MP 17.0. First, the data is transferred into STATA by downloading the datasheet from *nettskjema* as a tab-separated text file and then exported into STATA. All questions were mandatory in the survey. Therefore, there are no missing values. Furthermore, all variables are made numeric to avoid error messages. Then, all of the variables were labelled and recoded if needed. Next, the descriptive statistics were done on the background, WATs use characteristics and variables utilised in the analysis. Then, a correlation analysis and a multi-linear regression analysis were conducted. The statistical value utilised in this thesis is $p<0.05$ to test the significance value.

4.5.1. Linear regression

A multi-linear regression was utilised in the present study to examine the relationship between PA levels as the dependent variable and WATs use, psychological needs, autonomous motivation, gender, age and education as independent variables.

Certain assumptions need to be taken into account when performing linear regression. The first assumption to check is the linearity assumption, which involves checking whether all relevant variables are included in the model. The model should, however, not include variables that are not theoretical, as they can give false significant results (Mehmetoglu & Jakobsen, 2017). All variables are justified by theory and previous research; therefore, all are considered relevant. In addition, various statistical tests can be performed in Stata to check the linearity assumption.

The first test performed was a *linktest* that indicates whether one is missing some relevant variables. The test result presented a *hat* of 0.640 and *hatsq* of 0.045, which suggests

possibilities for non-linear relationships (Midtbø, 2012). In addition, the *ovtest* was performed with a non-significant (p=0.103) result, indicating that the model has a sufficient linear form.

Furthermore, a linear regression assumes that the dependent variable is normally distributed. A normally distributed residual means the residuals should lie as close to a 45-degree line as possible and the residual is perfectly distributed if the residuals lie entirely on the line (Midtbø, 2012). Therefore, a q-plot and histogram were performed (Appendix 7). The results showed that there is not a perfect distribution; however, it is not problematic.

A *vif*-test was also carried out to examine the model for multicollinearity. A *vif* value of less than ten can confirm the absence of multicollinearity (Midtbø, 2012). The test results showed that the mean value of the model (1.83) and the value for each variable was way below 10. Therefore, it is concluded that there does not occur multicollinearity in the regression model. The absence of heteroscedasticity is also one of the assumptions which describe the variation around the regression line (Midtbø, 2012). Hence, a *hettest* was performed, which showed an indication of heteroscedasticity (p=0.02). In order to avoid heteroscedasticity, a command that calculates corrected standard error was used through the *robust* command in Stata (Midtbø, 2012). Based on this, a *robust* model was utilised. One of the most important assumptions is whether the residuals are uncorrelated with the independent variables and are most often specification errors (Skog, 2017). This has been neutralised by choosing variables based on theory and previous research, which indicate that all the variables are relevant even if some of them have not been shown to be significant in the model.

Since the model did not meet the linearity assumption in the *linktest*, it was chosen to check for interaction effects between the variables to examine any interaction between the independent variables (Midtbø, 2012). If the interaction contributes to an improvement, it must be significant ($p<0.05$) and improve the model in the form of a higher pseudo-R2 (Ringdal & Wiborg, 2017). It was performed a second degree on the variable age since the theory indicates that the variable age is not linear, however, it is more u-shaped. However, the test showed no significance, and the variable age was insignificant. Therefore, the second-degree variable was not included. There were not performed any other second-

degree tests since the continuous variables are expected to be linear. In a regression model, the independent variable can depend on another independent variable to connect to the dependent variable (Skog, 2017). Therefore, there is performed an interaction test between the variable age and gender because of the theory indicating that males are more physically active than females. The interaction showed no significant value and was therefore not included.

4.6. Reliability and validity

This section presents thoughts on the reliability and validity of this thesis methodology. Reliability and validity are measurements of the quality of research methods, considering whether the research results are valid and whether there are any possibilities of errors. It is essential for researchers to be aware of the potential errors that may arise and to be critical of their research (Rindal, 2014). However, it is essential to note that validity and reliability are not an absolute quality but rather a standard that should be approximately met.

Reliability is a crucial aspect related to the consistency and accuracy of the measurements taken during a study. For example, random errors can occur during the data collection, such as unclear instructions or external disturbances, which can impact the reliability of the study. To evaluate the reliability of a study, there are a variety of methods available, such as measuring the degree of internal consistency between different indicators in the data (Ringdal, 2014). In this present thesis, Cronbach's alpha was used in STATA to measure this degree of consistency, and all the reliability analyses indicated satisfactory values, indicating a reliable study (Ringdal, 2014). In addition, checking for transparency is a key factor that can positively influence the credibility of a study. Transparency refers to the degree to which the study's methodology is clear and precise, allowing readers to assess the quality of the research (Nardi, 2014). This thesis aims to achieve reliability by being transparent in its methodology and providing an accurate description of the entire research process, which could help establish its credibility.

Validity in research is about how valid the data collection is and measuring what the research question is saying. Therefore, it is crucial to have good levels of preparedness regarding the connection between the theoretical foundation selected and the

methodology. Conceptual validity concerns the relationship between the phenomenon that is examined and the data that are collected and whether there is agreement between the phenomena and the measurements that have been taken (Ringdal, 2014). Using questionnaires that have been previously used and validated can significantly strengthen the concept validity. The established instruments utilised in the survey have been multiple times assessed for *validity* and will therefore ensure the quality of the measurement.

An established instrument was used to measure PA, which helped to increase the validity of the study. However, when replying to self-reported questionnaires to measure PA, there is a risk that participants may interpret the questions differently or report higher levels of activity than their actual levels due to social desirability bias or other factors (Ringdal, 2014). The present study utilised an anonymous survey format, which can help to increase perceived confidentiality and reduce social desirability bias. In order to measure the participant's autonomous motivation in PA, the study chose to utilise RAI, which is a widely used measure for autonomous motivation and is considered an essential component of the SDT framework (Howard et al., 2020). However, it is important to note that the RAI does not provide detailed information about each regulation but whether it is positive or negative. Therefore, researchers should be aware of the limitations of the RAI when utilising it to measure autonomous motivation in PA. Nevertheless, the RAI is still considered a good measurement instrument.
This thesis's theoretical framework is well-known and commonly used in this field. The instruments are well-known, established in the field, and validated in different contexts. Based on this, reliability and validity have been significantly addressed in this study.

5.0. Results

This chapter presents the findings from the survey and is divided into four parts (Appendix 1). The first part describes the WATs characteristics. The second part shows the descriptive statistics of the variables used in the analysis. The third part shows the bivariate analysis of the variables used (correlation analysis), and the last and fourth part shows the multivariate analysis with a linear regression model of the variables.

5.1. WATs characteristics

Out of the 217 participants who completed the survey, 141 (64.98%) used WATs, 54 (24.88%) did not use WATs, and 22 (10.14%) had previously used WATs (Appendix 6). Combining the no group and group that has used WATs before, the non-users are 76 (35.02%) participants who report no use of WATs.

Out of the 141 participants using WATs, the most used type of WATs was Polar (n=50) and Garmin (n=42), with the least used being Xiaomi (n=0) and Huawei (n=2) (Appendix 6). Seventy-one participants out of the total 217 participants had used the device between 1 to 5 years (n=71, 50.35%), with 38 participants using a device for 5 to 10 years (n=38, 26.95%) (Appendix 6). The most used features of the devices were watch (n=127), pulse (n=123), step count (n=116) and distance (n=108), with the least used feature being blood pressure (n=9). The results also show that most WATs users thought that the device had met their expectations, with the answers 4 (n=66) and to a large degree (n=36) the most answered (Appendix 6). Among the users, most participants utilised the devices for both tracking daily activity and exercise (N=99).

5.2. Descriptive statistics

This section describes the descriptive statistics of the quantitative findings. Table 1 shows the descriptive statistics of the variables utilised in this thesis divided into WATs users, non-users, and total value.

Table 1: *Descriptive statistics (N=217)*

		WATS USERS		**NON-USERS**		**TOTAL**
	N	**M (SD)**	**N**	**M (SD)**	**N**	**M(SD)**
TOTAL PA	141	1737(1013)	76	1914(876)	217	1832(1805)
AUTONOMY SATISFACTION	141	3.74(0.79)	76	3.56(0.79)	217	3.68(0.79)
AUTONOMY FRUSTRATION	141	1.84(0.70)	76	2.07(0.62)	217	1.92(0.68)
COMPETENCE SATISFACTION	141	3.97(0.73)	76	3.71(0.84)	217	3.88(0.78)
COMPETENCE FRUSTRATION	141	1.79(0.77)	76	2.09(0.91)	217	1.90(0.84)
RELATEDNESS SATISFACTION	141	3.36(0.95)	76	3.23(0.86)	217	3.31(0.92)
RELATEDNESS FRUSTRATION	141	1.45(0.54)	76	1.62(0.66)	217	1.51(0.59)
RAI	141	14.11(5.60)	76	10.88(7.66)	217	12.98(6.56)

Total PA shown in median (interquartile range)

The descriptive statistics of Table 1 show a median value of 1831 MET-minutes/week for the total PA levels. The minimum and maximum values range from 0 to 9012 MET-minutes/week. Regarding satisfaction with basic psychological needs, competence satisfaction has the highest average value of 3.88, followed by autonomy and relatedness satisfaction. All satisfaction needs ranged from 1 to 5. The frustration of the needs showed autonomy frustration, the highest average value, closely followed by competence frustration and relatedness frustration. These ranged from 1 to 4.75. In terms of autonomous motivation measured by RAI, it ranged from a minimum value of -12.75 and a maximum value of 23.

5.2. Bivariate analysis

In this section, the results are presented of the bivariate analysis conducted with a correlation analysis of the variables. Table 2 shows the correlation analysis. There was no correlation between WATs use and PA. The findings indicate that relatedness satisfaction (0.29) and RAI (0.24) are the two variables most correlated with PA with a p-value of less than 0.01. Moreover, PA was positively correlated with competence satisfaction (0.23) and autonomy satisfaction (0.18), with a p-value of less than 0.01.

The correlation analysis revealed that WATs use has a significant positive correlation with competence satisfaction (0.16) and RAI (0.24) with a p-value of less than 0.01. Additionally, there was a negative correlation found between WATs use and autonomy frustration (-0.16) and competence frustration (-0.18) with a $p<0.01$. Furthermore, RAI was significantly positively correlated with autonomy satisfaction 0.70, competence satisfaction 0.68, and relatedness satisfaction 0.42 ($p<0.01$). At the same time, RAI showed a negative correlation with autonomy frustration -0.31 and competence frustration -0.34 ($p<0.01$).

Gender showed a weak positive correlation with relatedness satisfaction of 0.14 ($p<0.05$) and a weak positive correlation with autonomous motivation of 0.22 ($p<0.01$). Age has shown a weak negative correlation with autonomy satisfaction of -0.17, autonomy frustration of -0.17, competence frustration of -0.20 ($p<0.01$) and autonomous motivation of -0.15 ($p<0.05$). Education showed a weak positive correlation with relatedness satisfaction of 0.18 and autonomous motivation of 0.20 ($p<0.01$). Along with a weak negative correlation with competence frustration of -0.17 ($p<0.05$).

***Table 2**: Correlation analysis of variables (N=217)*

VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12
1. TOTAL PA	1.00											
2. WATS	-0.05	1.00										
3. AUTONOMY SATISFACTION	0.18**	0.11	1.00									
4. AUTONOMY FRUSTRATION	0.05	-0.16*	-0.09	1.00								
5. COMPETENCE SATISFACTION	0.23**	0.16*	0.64**	-0.24**	1.00							
6. COMPETENCE FRUSTRATION	-0.07	-0.18**	-0.13	0.61**	-0.48**	1.00						
7. RELATEDNESS SATISFACTION	0.29**	0.07	0.50**	0.01	0.51**	-0.13	1.00					
8. RELATEDNESS FRUSTRATION	-0.05	-0.13	-0.05	0.35**	-0.13	0.38**	-0.24**	1.00				
9. RAI	0.24**	0.24**	0.70**	-0.31**	0.68**	-0.34**	0.42**	-0.13	1.00			
10. GENDER	-0.09	0.09	0.12	-0.06	0.10	-0.009	0.14*	-0.11	0.22**	1.00		
11. AGE	-0.10	-0.04	-0.17**	-0.17**	-0.12	-0.20**	-0.13	-0.05	-0.15*	-0.19**	1.00	
12. EDUCATION	-0.005	0.04	0.11	-0.09	0.09	-0.17*	0.18**	-0.002	0.20**	0.06	0.000	1.00

*p<0.05, **p<0.01

5.3. Multi-linear regression analysis

Multi-linear regression statistics were used to examine the dependent and independent variables since one factor rarely explains a phenomenon. A multi-linear regression analysis was therefore performed.

Table 3: *Robust multiple linear regression model with total PA as dependent variable (N=217)*

TOTAL PA	Coefficient	Robust Std.err.	t	P>t	[95% conf.	interval]
WATS	-345.6151	223.1972	-1.55	0.123	-785.6716	94.44137
AUTONOMY SATISFACTION	-215.1863	172.2445	-1.60	0.112	-614.7842	64.41148
AUTONOMY FRUSTRATION	329.0228	177.4392	1.85	0.065	-20.81693	678.8625
COMPETENCE SATISFACTION	4.296259	215.3067	0.02	0.984	-420.2031	428.7956
COMPETENCE FRUSTRATION	-147.655	180.6218	-0.82	0.415	-503.7696	208.4597
RELATEDNESS SATISFACTION	434.4024	141.2574	3.08	0.002*	155.8987	712.906
RELATEDNESS FRUSTRATION	-26.91665	227.6231	-0.12	0.906	-475.6991	421.8658
RAI	76.76339	24.02227	3.20	0.002*	29.40099	124.1258
GENDER	-591.2032	223.1791	-2.65	0.009*	-1031.224	-151.1825
AGE	-7.826809	7.023318	-1.11	0.266	-21.67401	6.020389
EDUCATION	-122.8875	91.15925	-1.35	0.179	-302.6174	56.84237
_CONS	1879.231	1073.02	1.75	0.081	-236.3383	3994.801
NUMBER OF OBS	217					
F(11,205)	4.56					
PROB > F	0.0000					
R-SQUARED	0.1724					
ROOT MSE	1470					

*P<0.01

In Table 3, the regression model is shown. The model shows a statistical significance through the f-test ($p<0.01$) with an explanatory power of 0.17, which means that the model explains 17% of the variance within total PA levels. The regression model shows that relatedness satisfaction and RAI have the most significant variance, with p-values of 0.002 and a coefficient of 434.4 and 76.8. Gender also shows a significance of $p=0.009$ with a negative coefficient of -591.2. The variables WATs use, autonomy satisfaction and frustration,

competence satisfaction and frustration and relatedness frustration, are insignificant, along with age and education.

6.0. Discussion

In summary, the thesis findings show no connection between using WATs and being physically active. Despite that WATs users are more self-motivated than non-users and feel more competent for PA when using WATs. In addition, WATs users also feel more satisfied with their autonomy and competence. Regarding motivation for PA, self-motivated people tend to be more physically active. Meeting the need for relatedness satisfaction is the most significant factor in motivating people to be physically active in this thesis. Gender was also shown to play a role in PA.

6.1. Are WATs users more active than non-users of WATs?

WATs have commonly been used as a health-related tool to increase PA levels, and research has shown that it is correlated to higher PA levels (Teixeira et al., 2012; Ferguson et al., 2022). The results of the study showed no correlation between total PA levels and WATs use (Table 2; $p<0.05$). WATs users reported a median value of 1737 (1013) MET-minutes/week and non-users a value of 1914 (876) MET-minutes/week with an overall median value of 1832 (1802) MET-minutes/week for the whole sample of participants (Table 1). These values exceed the recommendations of 150 to 300 minutes of moderate-intensity or 75 to 150 minutes of vigorous-intensity since it equals 500 to 1000 MET-minutes/week (U.S. Department of Health and Human Services, 2008; Helsedirektoratet, 2023; World Health Organisation, 2023) in contrast to the general population of Norway, where only three out of ten adults are shown to meet the recommendations for PA (Folkehelseinstituttet, 2023). However, the current PA values are similar to those reported in a study conducted by Joseph et al. (2021), which used the IPAQ-SF instrument and reported total PA values of 1985 MET-minutes/week. The total PA levels ranged from 0 to 9012 MET-minutes/week, a significant range. However, with the major differences between PA levels among the adult population, with some being very physically active and some not being physically active, it would be considered normal to have differences in PA levels (Folkehelseinstituttet, 2023).

These findings indicate that WATs users and non-users are equally likely to participate in PA (Table 1; Table 2). In contrast, a systematic review by Ferguson et al. (2022) reported

positive correlations between WATs use and PA levels. The review reported that 89% of the research papers favoured the intervention groups utilising WATs devices to increase PA. Another systematic review by Brickwood et al. (2019) found a significant increase in daily step count and moderate and vigorous PA using a WATs device as a PA intervention. Additionally, several intervention studies examining WATs impact on PA levels have reported that WATs use is an acceptable tool for increasing PA levels (Black & Brunet, 2021; Bayerle et al., 2022). Black & Brunet (2021) compared WATs use in an intervention setting with a control group and a group that utilised WATs combined with supported emails. The study found that the group utilising WATs increased from around 300 MET-minutes/week to over 800 MET-minutes/week, the control group increased from under 100 MET-minutes/week to 600 MET-minutes/week, and the group utilising WATs combined with supported emails increased from 40 MET-minutes/week to 360 MET-minutes/week. These results showed that the WATs group had the highest increase in MET-minutes/week. Considering the present study examines WATs use in an everyday life situation and previous research, for the most part, examining in an intervention setting, it can indicate that WAT use has a higher impact and relation with PA participation in an intervention-based setting where the device are utilised more specifically towards increasing PA with help of physicians over a specific period.

Black & Brunet (2021) also found that the group utilising WATs combined with supported emails had the highest increase in walking. This might suggest that WATs use combined with other elements such as supported email might be a better solution to increase PA participation considering the present thesis found no relationship between WATs use and PA. However, a study by Bayerle et al. (2022) that examined WATs use with technical support found a decrease in total PA, which may indicate that there was no need for technical support. However, there may be more need for health-related support and advice through, for example, a personal trainer or health supervisor combined with WATs use.

Nevertheless, the present study does not consider the participants` PA levels before utilising a device, with many participants reporting high satisfaction and expectations with the device (Appendix 6). This may indicate that WATs use can improve PA levels for the users. At the same time, there are differences in the duration of WATs use among the participants. Previous research has suggested that WATs use has a short-term effect on PA (Kerner &

Goodyear, 2017). However, the present study shows that most participants have utilised the device for over a year, which may indicate that the impact of WATs on PA has stagnated. However, the study participants have reported moderate to high levels of PA, indicating that the WATs users in this study have used the device to impact their PA participation and make them reach the recommended levels of PA participation.

6.2. Are WATs users more motivated for PA than non-users of WATs?

Motivation is often associated with PA participation, and WATs devices have been suggested to be a motivational tool to increase PA levels (Friel & Garber, 2020; Nüss & Li, 2021). The thesis results found that autonomous motivation had the highest correlation with WATs use ($p<0.05$; Table 2). WATs users reported higher levels of RAI with a value of 14.11 compared to 10.88 for non-users (Table 1), with both groups having values over ten, indicating that both groups have a more autonomous form of motivation. The results indicate that WATs users have higher autonomous motivation than non-users, which suggests that WATs users have a greater extent, a more direct intention towards PA participation than non-users and a higher feeling of control and choice in the activities carried out. This might be because individuals utilising WATs devices might have a more active role in their PA participation with feedback from the device about the PA participation. Previous research has shown that WATs use can positively influence autonomous motivation for PA (Nüss et al., 2021; Friel & Garber, 2020).

Even though the present study found a correlation between autonomous motivation and WATs use, with WATs users having higher values, the study did not find any correlation between WATs use and PA levels (Table 1; Table 2). These results, therefore, indicate that a difference in autonomous motivation does not necessarily predict PA levels. Similarly to PA levels, RAI also have a range of considerable size. The range indicates differences in motivation among the participants. However, the range may be expected with the differences in PA levels among the participants since it is suggested that low PA levels imply lower autonomous motivation for PA.

In addition, most WATs users reported having utilised a device for over a year (Appendix 6). Previous research has, however, suggested that duration of WATs use over eight weeks can lead to decreased autonomous motivation and increased amotivation (Kerner & Goodyear, 2017). In contrast, another study found that WATs users who had used the device for a more

extended period had a more meaningful initiation of the WATs use, starting with small goals and gradually increasing the goals (Peng et al., 2021). A study by Rupp et al. (2016) showed that trust towards the device and motivation are correlated and that there is a correlation between trust and intrinsic motivation, which could predict the desire to continue WATs use. Based on the result of the present thesis, this might indicate that WATs users have more traits that make using WATs helpful for them. For example, the WATs users might feel a higher trust for the device and higher intrinsic motivation, with most WATs users reporting a high satisfaction with the device. However, there was no correlation between WATs use and PA levels, which indicates that the non-users of WATs manage to reach high levels of PA without a device. Therefore, the non-users in this study might not be suitable for WATs use.

The basic psychological needs of autonomy, competence and relatedness are common motivational factors within SDT. The study's results showed that WATs use was positively correlated with competence satisfaction ($p<0.05$). WATs users were found to have higher levels of competence, with WATs users reporting values of 3.97 and non-users with an average value of 3.71 (Table 1). These results indicate that WATs users have a higher competence satisfaction in relation to PA. Even though the satisfaction of competence in relation to PA is shown to be higher in WATs users, there is no difference in PA levels between WATs users and non-users, indicating that WATs devices are not motivational tools for everyone. Previous research has shown that competence satisfaction is essential for PA participation (Deci & Ryan, 2000; Vlachopoulos & Michailidou, 2006). Similarly to the present study that found competence to correlate with PA, however, the regression analysis only found relatedness satisfaction to be an explanatory factor for PA levels (Table 2; Table 3). Considering the high PA levels in the study, this might explain why both groups have high levels of competence towards PA, and even though the WATs use group has higher competence satisfaction, this does not result in higher PA levels, which might have been expected. These results also suggest that competence satisfaction and autonomous motivation towards PA are essential for utilising WATs.

Autonomy satisfaction showed no significant correlation with WATs use, with values of 3.74 for WATs users and 3.56 for non-users of WATs (Table 1; Table 2). Indicating both WATs users and non-users participating in this study have similar feelings of choice, control, and autonomy towards PA participation. Similarly, relatedness satisfaction showed no significant

correlation with WATs use (Table 2). WATs users reported an average value of 3.36 and non-users 3.23 (Table 1) indicating similar results of relatedness satisfaction. These results suggests that both WATs users and non-users in the study both have relatively high feeling of satisfaction for autonomy and relatedness satisfaction which would be expected because of the high PA levels where higher scores of autonomy satisfaction and relatedness satisfaction are associated with higher PA levels (Deci & Ryan, 1985; Gagne & Deci, 2005).

In addition, the frustration of autonomy and competence showed a negatively weak correlation with WATs use (Table 2). WATs users reported values of 1.84 for autonomy frustration and 1.79 for competence frustration, with non-users reporting values of 2.07 for autonomy frustration and 2.09 for competence frustration (Table 1). However, relatedness frustration showed no correlation with WATs use, with reported values of 1.45 for WATs users and 1.62 for non-users. No standard scores are provided for the need frustration, but previous research has shown lower scores around 2 for frustration in all needs (Chen et al., 2015). However, a study by Kaap-Deeder et al. (2022) found frustration scores of 2.8 for autonomy, 2.41 for competence and 2.01 for relatedness. These findings indicate that the present study participants have quite low scores of frustration in all needs. However, WATs users are shown lower needs, with all values being under two compared to non-users. These results indicate that WATs users have a lower frustration for autonomy and competence, which would be expected because they have higher satisfaction levels than the non-users. The presence of need frustration often implies low scores of need satisfaction, which is described as when individuals feel isolated, pressured, and in conflict, their psychological needs will not be met. The findings of the present study imply that both WATs users and non-users have low need frustration, which indicates that the participants in this study do not feel isolated, pressured or like a failure concerning PA participation. In addition, the findings show that the participants have high need satisfaction scores.

6.3. Self-determination and PA

One of the study's main findings indicates a weak positive correlation between RAI and total PA levels among adults, suggesting a connection between RAI and PA participation ($P<.01$; Table 2). Additionally, the regression analysis showed that autonomous motivation was an explanatory factor for PA ($p<0.01$; Table 3). The average value of RAI for the participants is 12.89, which indicates that the participants have a more autonomous motivation (Table 1).

There are no reported extensive RAI scores; therefore, they are hard to compare. However, these findings are consistent with previous research, highlighting the importance of autonomous and self-determined motivation in an adult's PA participation (Edmunds et al., 2006; Teixeira et al., 2012). A study by Teixeira et al. (2018) found that autonomous motivation is a crucial predictor of PA participation, further supporting the present thesis. Autonomous motivations are suggested to be more correlated to PA because they are shown to be a part of the person's value and appear essential. Therefore, according to research, SDT-based interventions can increase autonomous motivation, resulting in increased PA participation (Ntoumanis et al., 2021).

SDT emphasises the importance of fulfilment of the three basic psychological needs to participate in PA (Deci & Ryan, 1985; Gagne & Deci, 2005). The correlation analysis also found a strong correlation ($P<.01$) between RAI, autonomy, and competence, while relatedness has a moderate correlation. These results align with SDT, emphasising that meeting the three basic psychological needs can lead to higher autonomous motivation (Ryan & Deci, 2000; Gagne & Deci, 2005). Thus, the findings of this study suggest that adults who have a high sense of satisfaction with their basic psychological needs are more likely to feel self-determined when engaging in PA. Conversely, adults who feel low satisfaction with their basic psychological needs are less likely to experience self-determination in their PA.

One of the main findings of the study found that relatedness satisfaction had the strongest correlation with PA, followed by competence satisfaction (0.23) and autonomy satisfaction (0.18) ($p<0.05$). In addition, relatedness satisfaction was the only basic psychological need found to have an explanatory factor on PA ($p<0.01$; Table 3). These results indicate that the participants of this thesis have a higher need for belonging with people and the importance of other people participating in PA. Overall, the participants in this study reported average values of autonomy satisfaction of 3.68, competence of 3.88 and relatedness of 3.31 (Table 1). These values were found to be higher for autonomy and competence, while relatedness was found to be lower than in a previous study by Kaap-Deeder et al. (2022). Kaap-Deeder et al. (2022) reported satisfaction values of autonomy of 3.53, competence of 3.79, and relatedness of 4.

This thesis reported relatedness satisfaction to be the highest correlated with PA in contrast to previous research that has shown autonomy and competence satisfaction more essential

for PA participation (Deci & Ryan, 2008; Gonzàlez-Cutre & Sicilia, 2012; Vlachopoulos & Neikou, 2007). This can imply that participants in the present study find relatedness and being social in PA important for participating. For example, this can mean the participants feel that having a training partner, group exercises, or comparing their training numbers with friends and family are essential for PA participation. In contrast to the present study, Withall et al. (2011) found that physically inactive people were more likely to rely on relatedness and feel the need for support from others, while the present thesis found that relatedness satisfaction is important in physically active individuals.

Moreover, the findings showed no significant correlation with the frustration of psychological needs. The results reported an average value of autonomy frustration of 1.92, competence frustration of 1.90 and relatedness frustration of 1.51 (Table 1). These numbers were lower than previous research that reported frustration values for autonomy of 2.8, competence at 2.41 and relatedness at 2.01 (Kaap-Deeder et al., 2022). These findings indicate that the current study participants have low frustration levels of basic psychological needs, which would be expected with the high levels of PA and satisfaction of the needs. Although the frustration values are lower than previous research, it has shown no correlation with PA. Previous research has shown that high frustration levels indicate feeling pressured to exercise, feeling like a failure, or experiencing social isolation and therefore suggested decreasing PA participation (Deci & Ryan, 2000; Ryan & Deci, 2017). Therefore, satisfying the three psychological needs is essential for participating in PA, while frustration with the psychological needs results in a negative outcome (Deci & Ryan, 2000; Vlachopoulos & Michailidou, 2006). These results suggest that it is important to satisfy the three basic psychological needs for PA participation. However, there was no correlation with the frustration of the needs, which might be unexpected because research indicates that lower frustration values would positively impact PA levels.

6.4. The influence of gender, age, and education

Gender, age, and education have been shown to affect PA levels (McCarthy & Warne, 2022; Westerterp, 2018; Ma et al., 2016). The present thesis findings showed that gender significantly relates to PA ($p<0.01$) and has a negative coefficient of 591 (Table 3). This shows that males have higher PA levels for this sample than females. These results support previous research that has indicated that males are more physically active than females

(McCarthy & Warne, 2022; Azevedo et al., 2007). Regarding motivation, the findings show that gender is positively correlated with satisfaction of relatedness and autonomous motivation (Table 2). These results indicate that females need more social connections and autonomous motivation than males to participate in PA.

Age is another factor associated with influencing PA levels (Westerterp, 2018). The present thesis found no significant indication of age affecting PA levels (Table 3). Still, a negative coefficient (7,8) was found, which indicates that younger people are more active than older people. These indications support previous research, which suggests that younger people have higher PA and that PA levels decrease with age because of the natural ageing process in the body (Milanovic et al., 2013; Folkehelseinstituttet, 2022). However, the results were non-significant. This might be because of a higher number of younger people completing the study, like the sample size between 18 and 40 is higher than between 40 and 64 years old. In addition, the correlation findings showed that age negatively correlated with autonomy satisfaction, autonomy frustration, competence frustration and autonomous motivation, which suggests younger individuals have higher values of autonomy satisfaction and autonomous motivation as well as autonomy and competence frustration.

Additionally, education is often associated with affecting PA levels (Ma et al., 2016; Kari et al., 2020). The present study found no significant indication that education affects PA levels for the participants in the study (Table 2, Table 3). The regression model, however, found a negative coefficient indicating that people with less education are more physically active. However, there was no significant result (Table 3). Previous research has, however, shown that people with higher education are more physically active, but this study does not support that. This might be because of the higher number of younger people who, therefore, have yet to have time to complete higher education. The present thesis, however, has a larger sample size that has completed higher education than those not completed higher education of at least a bachelor's degree. A study by Kari et al. (2020) reported the mean years of education to be 13, which is completing high school. Kari et al. (2020) showed that one additional year of education leads to higher PA levels. A study by Ma et al. (2016) found that people with a bachelor's degree or more are more likely to be physically active than people with less education than a bachelor's degree. Therefore, because the study has fewer

participants who have less education than a bachelor's degree, it may have affected the results.

6.5. Limitations

A limitation of this study is the limited sample size of 217 respondents, which could have implications on the external validity of the findings, as the convenience sample used may not represent the entire adult population in Norway. Furthermore, there is a difference in sample size between WATs users and non-users, and a higher number of younger people as well as females that completed the survey, potentially leading to a biased sample. To address this, the survey was distributed to various businesses to obtain a more diverse sample. However, there still was differences in age and gender among the sample. Additionally, a limitation of the study might be that more physically active people might be more likely to answer survey about PA because of being more interested in PA.

Another limitation of the study is the study design used, which is a survey, relies on the subjective opinions of the respondents. For example, the survey measured PA levels, which are often overreported. In the present thesis, participants reported moderate to high levels of PA, which may be due to the subjective nature of the research method. In an attempt to avoid this, the study utilised an established instrument that has been validated to measure PA among the adult population. It can be more convenient compared to other studies. Additionally, respondents may answer questions based on social desirability bias, but the survey was anonymous, which should mitigate this effect. In addition, the survey length could have affected the participant's answers, as the survey was quite long, potentially leading to boredom or fatigue. To counteract this effect, the questions on PA levels were placed earlier in the survey to avoid overreporting. An additional limitation of the study is the use of RAI, which makes the study miss some information about the motivational factors of each regulation. However, the study aimed to investigate autonomous motivation, which is feasible with the measure of RAI. Additionally, the regression model had a low explanatory power of 17% which suggests that there are other factors influencing PA. Overall, it is essential to consider these limitations when interpreting the study results.

7.0. Summary and future directions

In summary, the study's outcome indicates no relationship between WATs use and PA levels. However, it has been found that WATs use is correlated to autonomous motivation and competence satisfaction. This indicates that WATs use may impact motivation for some individuals, or those with higher autonomous motivation and competence satisfaction may be likelier to use WATs devices. The study's results might indicate that WATs use has more impact on PA levels in intervention-based settings than in everyday life. At the same time, negative correlations was shown between WATs use, autonomy frustration and competence frustration. The study also found that PA is correlated with autonomous motivation and satisfaction of the three basic psychological needs, emphasising the importance of relatedness and autonomous motivation in promoting PA in the study sample of this thesis. Therefore, it would be recommended to consider an individual's fulfilment of the three basic psychological needs, which will lead to a more autonomous motivation.

This thesis has examined how WATs use, psychological needs and motivation are connected together with PA. As there were only a few significant connections between the motivational factors and activity levels for the regression analysis in this sample, it would be interesting to examine similar studies with different selections to shed light on connections that were not found in this sample. Additionally, future research could examine the relationship between WATs use with support, such as a health professional and the influence on PA levels. As well as investigate how each regulation of OIT can affect WATs use and PA levels. Furthermore, gender differences should be explored since the present study has shown differences between genders.

8.0. References

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Appendix overview

Appendix 1: Survey

Appendix 2: Indexes BPNSFS

Appendix 3: Reliability analysis BPNSFS

Appendix 4: Indexes BREQ-3

Appendix 5: Reliability analysis BREQ-3

Appendix 6: Characteristics of WATs use.

Appendix 7: Normal distribution tests

Appendix 1

Nettskjema

En undersøkelse om hvordan sosiale medier og aktivitetsmålere påvirker treningsmotivasjon og fysisk aktivitetsnivå blant voksne

Vi er to masterstudenter i idrettsvitenskap ved NTNU Trondheim. I den forbindelsen ønsker vi voksne (18-64 år) til å delta i et forskningsprosjekt hvor formålet er å undersøke sammenhengen mellom bruken av sosiale medier og aktivitetsmålere opp mot motivasjon for trening og fysisk aktivitetsnivå. Deltakelse i spørreundersøkelsen krever ingen forutsetninger om bruk av sosiale medier og aktivitetsmålere, og derfor vil alle bidrag være verdifulle.

Det er frivillig å delta, og deltakelsen er anonym. Ingen opplysninger vil kunne spores tilbake til deg. Du kan når som helst avbryte undersøkelsen underveis, men hvis du fullfører spørreskjemaet og sender inn svarene, gis det samtidig samtykke til deltakelse i prosjektet.

Hvis du har spørsmål til studien ta kontakt med oss eller vår veileder:
Student: Lene Winsents Alnes - lkalnes@stud.ntnu.no
Student: Kine Marie Johansen - kmjohans@stud.ntnu.no
Veileder: Ingar Mehus - ingar.mehus@ntnu.no

Det vil ta inntil 15 minutter å gjennomføre spørreundersøkelsen.

Bakgrunn

1. Hvilket kjønn identifiserer du deg med?

- Kvinne
- Mann
- Annet

2. Fødselsår?

- 1959
- 1960
- 1961
- 1962
- 1963
- 1964
- 1965
- 1966
- 1967
- 1968
- 1969
- 1970
- 1971
- 1972
- 1973

1974
1975
1976
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1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005

3. Hvilken utdanning er den høyeste du har fullført?

Mindre enn 7 år grunnskole
Grunnskole 7-10 år, framhaldsskole eller folkehøyskole
Realskole, middelskole, yrkesskole, 1-2 årig videregående skole
Artium, økonomisk gymnas, allmennfaglig retning i videregående skole
Høyskole/universitetsutdanning (<4år)
Høyskole/universitetsutdanning (4 år eller mer)

4. Hva er din hovedaktivitet?

Yrkesaktiv heltid
Yrkesaktiv deltid
Arbeidsledig
Hjemmeværende
Pensjonist/trygdet
Student/militærtjeneste

Kartlegge bruken av aktivitetsmålere

17. Bruker du en aktivitetsmåler?

En aktivitetsmåler kan i denne sammenheng defineres som en enhet som måler aktivitet ved å kunne bæres på kroppen. Eksempler kan være klokker, armbånd osv.

- Ja
- Nei
- Har brukt tidligere

18. Hva er årsaken til at du sluttet å bruke aktivitetsmåler?

Dette elementet vises kun dersom alternativet «Har brukt tidligere» er valgt i spørsmålet «17. Bruker du en aktivitetsmåler?»

19. Hvilken type aktivitetsmåler bruker du?

Dette elementet vises kun dersom alternativet «Ja» er valgt i spørsmålet «17. Bruker du en aktivitetsmåler?»

- Fitbit
- Garmin
- Polar
- Apple Watch
- Samsung Galaxy Watch
- Xiaomi
- Huawei
- Annet

20. Hvor lenge har du brukt en aktivitetsmåler?

Dette elementet vises kun dersom alternativet «Ja» er valgt i spørsmålet «17. Bruker du en aktivitetsmåler?»

- <6 måneder
- 6-12 måneder
- 1-5 år
- 5-10 år
- >10 år

21. Når bruker du aktivitetsmåleren?

Dette elementet vises kun dersom alternativet «Ja» er valgt i spørsmålet «17. Bruker du en aktivitetsmåler?»

- Daglig aktivitet
- Trening
- Daglig aktivitet og trening

22. Hva er hovedårsaken til at du bruker aktivitetsmåler?

Dette elementet vises kun dersom alternativet «Ja» er valgt i spørsmålet «17. Bruker du en aktivitetsmåler?»

23. I hvilken grad føler du at aktivitetsmåleren tilfredsstiller forventningene dine?

Dette elementet vises kun dersom alternativet «Ja» er valgt i spørsmålet «17. Bruker du en aktivitetsmåler?»

- 1 I liten grad
- 2
- 3
- 4
- 5 I stor grad

24. Hvilke funksjoner på aktivitetsmåleren bruker du?

Dette elementet vises kun dersom alternativet «Ja» er valgt i spørsmålet «17. Bruker du en aktivitetsmåler?»

- Klokke
- Stoppeklokke
- Skritteller
- Puls
- Distanse
- Trenings historikk
- Søvn mønster
- Kaloriforbrenning
- GPS
- Blodtrykk
- Annet

Kartlegge fysisk aktivitetsnivå og treningsvaner

Med fysisk aktivitet mener vi at du f.eks. går tur, går på ski, svømmer, sykler eller driver en annen form for mosjon/trening/idrett.

25. Hvor ofte driver du vanligvis fysisk aktivitet?

Ta et gjennomsnitt for en vanlig uke, sett bare ett kryss.

- Aldri
- 1-2 ganger pr. uke
- 3-4 ganger pr. uke
- 5-6 ganger pr. uke
- 7 ganger pr. uke eller mer

26. Hvor hardt driver du fysisk aktivitet?

Ta et gjennomsnitt for hver gang du driver fysisk aktivitet, sett bare ett kryss.

- Tar det rolig uten å bli andpusten og/eller svett
- Tar det så hardt at jeg blir andpusten og/eller svett
- Tar meg nesten helt ut

27. Hvor lenge holder du på hver gang?

Ta et gjennomsnitt for hver gang du driver fysisk aktivitet, sett bare ett kryss

- Mindre enn 30 minutter
- 30 minutter – 1 time
- Mer enn 1 time

Kartlegge fysisk aktivitetsnivå og treningsvaner

Vi er interessert i informasjon om ulike former for fysisk aktivitet som folk driver med i dagliglivet. Spørsmålene gjelder tiden du har brukt på fysisk aktivitet de siste 7 dagene. Vennligst svar på alle spørsmålene uansett hvor fysisk aktiv du selv synes du er. Tenk på aktiviteter du gjør på skole/jobb, som en del av hus- og hagearbeid, for å komme deg fra et sted til et annet og aktiviteter på fritiden (rekreasjon, mosjon og sport).

I denne undersøkelsen blir meget anstrengende og middels anstrengende definert slik:
Meget anstrendende - er fysisk aktivitet som får deg til å puste mye mer enn vanlig
Middels anstrengende – er fysisk aktivitet som får deg til å puste litt mer enn vanlig

28. Hvor mange dager i løpet av de siste 7 dagene har du drevet med meget anstrengende fysiske aktiviteter som tunge løft, gravearbeid, aerobics eller syklet fort?

Tenk bare på aktiviteter som varer minst 10 minutter i strekk.

- 1 dag
- 2 dager
- 3 dager
- 4 dager
- 5 dager
- 6 dager
- 7 dager
- Ingen

29. På en vanlig dag hvor du utførte meget anstrengende fysiske aktiviteter, hvor lang tid brukte du da på dette?

Oppgi svar i minutter.

30. Hvor mange dager i løpet av de siste 7 dagene har du drevet med middels anstrengende fysiske aktiviteter som å bære lette ting, sykle eller jogge i moderat tempo eller mosjonstennis?

Ikke ta med gange, det kommer i neste spørsmål.

- 1 dag
- 2 dager
- 3 dager
- 4 dager
- 5 dager
- 6 dager
- 7 dager
- Ingen

31. På en vanlig dag hvor du utførte middels anstrengende fysiske aktiviteter, hvor lang tid brukte du da på dette?

Oppgi svar i minutter.

32. Hvor mange dager i løpet av de siste 7 dagene, gikk du minst 10 minutter i strekk for å komme deg fra ett sted til et annet?

Dette inkluderer gange på jobb og hjemme, gange til buss, eller gange som du gjør på tur eller som trening i fritiden.

1 dag
2 dager
3 dager
4 dager
5 dager
6 dager
7 dager
Ingen

33. På en vanlig dag hvor du gikk for å komme deg fra et sted til et annet, hvor lang tid brukte du da totalt på å gå?

Oppgi svar i minutter.

34. I løpet av de siste 7 dagene, hvor lang tid brukte du vanligvis på å sitte på en vanlig dag.

Dette spørsmålet omfatter all tid du tilbringer i ro (sittende) på jobb, hjemme, på kurs, og på fritiden. Det kan være tiden du sitter ved et arbeidsbord, hos venner, mens du leser eller ligger for å se på TV.

Oppgi svar i timer.

35. Hvor ofte driver du vanligvis med disse treningsaktivitetene?

Utholdenhetsidrett (f.eks. løp/jogging, langrenn, sykling, svømming, friidrett)

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Lag-/ballidretter (f.eks. fotball, volleyball, håndball, ishockey)

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Estetisk idrett (f.eks. dans, turn, aerobics)

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Kampsport/styrkeidrett (f.eks. judo, karate, taekwondo, boksing, styrkeløft)

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Styrketrening, bodybuilding, fitness trening

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Tekniske idretter (f.eks. ridning, friidrett, hopp, rullebrett)

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Skiidrett (f.eks. alpint, snowboard, telemark)

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Friluftsliv (f.eks. fottur, skittur)

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Trener på treningssenter

Aldri
2-3 ganger i måneden eller sjeldnere
1 gang i uken
2-3 ganger i uken
4 ganger i uken eller mer

Motivasjon for trening og fysisk aktivitet

36. Hvorfor trener du?

Bruk skalaen nedenfor og marker i hvilken grad påstandene stemmer for deg.

Det er viktig for meg å trene regelmessig

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg ser ingen grunn til at jeg skal trene

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg trener fordi det er gøy

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg får dårlig samvittighet når jeg ikke trener

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg trener fordi det passer med målene i livet mitt

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg trener fordi andre sier jeg skal

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg verdsetter fordelene med trening

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg skjønner ikke hvorfor jeg skulle måtte trene

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg liker treningsøktene mine

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg skammer meg når jeg går glipp av en treningsøkt

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg ser på trening som en del av min identitet

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg trener fordi venner/familie/partner sier jeg bør

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg mener det er viktig å gjøre en innsats for å trene regelmessig

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg ser ikke noe poeng med å trene

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Trening er for meg lystbetont

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg føler meg mislykket når jeg ikke har fått trent på en stund

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg ser på trening som en fundamental del av hvem jeg er

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg trener fordi andre ikke vil være fornøyd med meg om jeg ikke gjør det

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg blir rastløs om jeg ikke trener regelmessig

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg mener trening er bortkastet tid

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg blir glad og tilfreds av å trene

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg ville følt meg dårlig om jeg ikke satte av tid til trening

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg anser trening som samsvarende med mine verdier

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

Jeg føler press fra venner/familie om å trene

0 Stemmer ikke
1
2 Stemmer av og til
3
4 Stemmer veldig

37. De følgene setningene referer til dine helhetlige erfaringer innenfor den treningen du bedriver.

Bruk skalaen nedenfor og marker i hvilken grad påstandene stemmer for deg.

Jeg har en følelse av valgfrihet i treningen jeg gjør

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Det meste av treningen jeg gjør føler jeg at jeg må gjøre

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler at personene jeg bryr meg om på trening også bryr seg om meg

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg utestengt fra den gruppen jeg ønsker å være en del av på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg trygg på at jeg kan gjøre det bra på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg er i alvorlig tvil om at jeg gjør det bra på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler at treningen jeg driver med er et uttrykk for hva jeg virkelig vil

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg tvunget til å gjøre ting på trening som jeg ikke ville valgt selv

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg veldig fortrolig med de andre på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler at personer som er viktige for meg distanserer seg fra meg på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler at jeg mestrer det jeg gjør på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg er skuffet over mange av mine prestasjoner på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler at mine valg i treningssammenheng uttrykker hvem jeg virkelig er

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg presset til å gjøre mye forskjellig i treningssammenheng

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg knyttet til andre personer som er viktige for meg på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg har et inntrykk av at personer jeg tilbringer tid med på trening ikke liker meg

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg kompetent til å nå mine mål på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg usikker på mine egne evner på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler at det jeg gjør på trening er noe som virkelig interesserer meg

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Treningen jeg gjør føles ut som en rekke forpliktelser

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg veldig bekvem med de andre jeg trener sammen med

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler at forholdene jeg har til andre på trening bare er overfladiske

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler at jeg kan gjennomføre vanskelige oppgaver på trening på en suksessfull måte

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Jeg føler meg mislykket på grunn av feilene jeg gjør på trening

Ikke sant i det hele tatt
Litt usant
Verken eller
Litt sant
Veldig sant

Sosial kompetanse og ensomhet

38. Her er noen påstander om ditt forhold til andre mennesker. Kryss av for hvor godt hver påstand stemmer for deg.

Jeg hjelper andre folk.

- Stemmer ikke i det hele tatt
- Stemmer litt
- Stemmer passe mye
- Stemmer ganske mye
- Stemmer veldig mye

Jeg spør andre om jeg kan være til hjelp.

- Stemmer ikke i det hele tatt
- Stemmer litt
- Stemmer passe mye
- Stemmer ganske mye
- Stemmer veldig mye

Jeg viser omtanke for andre.

- Stemmer ikke i det hele tatt
- Stemmer litt
- Stemmer passe mye
- Stemmer ganske mye
- Stemmer veldig mye

Jeg viser omsorg for andre.

- Stemmer ikke i det hele tatt
- Stemmer litt
- Stemmer passe mye
- Stemmer ganske mye
- Stemmer veldig mye

Jeg gir støtte til andre.

- Stemmer ikke i det hele tatt
- Stemmer litt
- Stemmer passe mye
- Stemmer ganske mye
- Stemmer veldig mye

39. Her er noen beskrivelser av ulike følelser folk kan ha. Kryss av for hvor ofte du selv føler disse følelsene.

Hvor ofte føler du deg isolert fra andre?

- Sjelden
- Av og til
- Ofte

Hvor ofte føler du, at du savner noen å være sammen med?

- Sjelden
- Av og til
- Ofte

Hvor ofte føler du deg utenfor?

- Sjelden
- Av og til
- Ofte

Takk for at du tok deg tid til å gjennomføre undersøkelsen!
Husk å trykk på "send" i høyre hjørne!

Appendix 2

Indexes for Basic Psychological Needs Satisfaction and Frustration Scale (BPNSFS)

Table: Index for autonomy

Index for Autonomy satisfaction
1. Jeg har en følelse av valgfrihet i treningen jeg gjør
7. Jeg føler at trening jeg driver med er et uttrykk for hva jeg virkelig vil
13. Jeg føler at mine valg treningssammenheng uttrykker hvem jeg virkelig er
19. Jeg føler at det jeg gjør på trening er noe som virkelig interesserer meg
Index for Autonomy frustration
2. Det meste av treningen jeg gjør føler jeg at jeg må gjøre
8. Jeg føler meg tvunget til å gjøre ting på trening som jeg ikke ville valgt selv
14. Jeg føler meg presset til å gjøre mye forskjellige i treningssammenheng
20. Trening jeg gjør føles ut som en rekke forpliktelser

Table: Index for competence

Index for competence satisfaction
5. Jeg føler meg trygg på at jeg kan gjøre det bra på trening
11. Jeg føler at jeg mestrer det jeg gjør på trening
17. Jeg føler meg kompetent til å nå mine mål på trening
23. Jeg føler at jeg kan gjennomføre vanskelige oppgaver på trening på en suksessfull
Index for competence frustration
6. Jeg er I alvorlig tvil om at jeg gjør det bra på trening
12. Jeg er skuffet over mange av mine prestasjoner på trening
18. Jeg føler meg usikker på mine egne evner på trening
24. Jeg føler meg mislykket på grunn av feilene jeg gjør på trening

Table: Index for relatedness

Index for relatedness satisfaction
3. Jeg føler at personene jeg bryr meg om på trening også bryr seg om meg
9. Jeg føler meg veldig fortrolig med de andre på trening
15. Jeg føler meg knyttet til andre personer som er viktig for meg på trening
21. Jeg føler meg veldig bekvem med de andre jeg trener sammen med
Index for relatedness frustration
4. Jeg føler meg utestengt fra den gruppen jeg ønsker å være en del av på trening
10. Jeg føler at personer som er viktig for meg distanserer seg fra meg på trening
16. Jeg har et inntrykk av at personer jeg tilbringer tid med på trening ikke liker meg
22. Jeg føler at forholdene jeg har til andre på trening bare er overfladiske

Appendix 3

Prerequisites for index building BPNSFS – Reliability

Table: Cronbach's Alpha test for indexes of BPNSFS – satisfaction and frustration

Factor	Autonomy satisfaction	Autonomy frustration	Competence satisfaction	Competence frustration	Relatedness satisfaction	Relatedness frustration
Average interitem covariance	0.44	0.26	0.50	0.55	0.61	0.22
Numbers of items in the scale	4	4	4	4	4	4
Scale reliability	0.70	0.56	0.83	0.78	0.73	0.65

Appendix 4

Indexes for Behavioural Regulation in Exercise Questionnaire 3 (BREQ-3). Each index are merged together to acquire the value of RAI.

Table: Index for amotivation

2. Jeg ser ingen grunn til at jeg skal trene
8. Jeg skjønner ikke hvorfor jeg skulle måtte trene
14. Jeg ser ikke noe poeng med å trene
20. Jeg mener trening er bortkastet tid

Table: Index for external regulation

6. Jeg trener fordi andre sier jeg skal
12. Jeg deltar i trening fordi venner/familie/partner sier jeg bør
18. Jeg trener fordi andre ikke vil være fornøyd med meg om jeg ikke gjør det
24. Jeg føler press fra venner/familie om å trene

Table: Index for introjected regulation

4. Jeg får dårlig samvittighet når jeg ikke trener
10. Jeg skammer meg når jeg går glipp av en treningsøkt
16. Jeg føler meg mislykket når jeg ikke har fått trent på en stund
22. Jeg ville følt meg dårlig om jeg ikke satte av tid til trening

Table: Index for identified regulation

1. Det er viktig for meg å trene regelmessig
7. Jeg verdsetter fordelene med trening
13. Jeg mener det er viktig å gjøre en innsats for å trene regelmessig
19. Jeg blir rastløs om jeg ikke trener regelmessig

Table: Index for integrated regulation

5. Jeg trener fordi det passer med målene for livet mitt
11. Jeg ser på trening som en del av min identitet
17. Jeg ser på trening som en fundamental del av hvem jeg er
23. Jeg ser på trening som samsvar med mine verdier

Table: Index for intrinsic motivation

3. Jeg trener fordi det er gøy
9. Jeg liker treningsøktene mine
15. Trening er for meg lystbetont
21. Jeg får glede og tilfredshet av å delta i trening

Appendix 5

Prerequisites for index building BREQ-3 – Reliability

Table: Cronbach's alfa test of the indexes in BREQ-3

Factor	Amotivation	External regulation	Introjected regulation	Identified regulation	Integrated regulation	Intrinsic motivation
Average interitem covariance	0.17	0.44	0.80	0.85	1.23	0.75
Umbers of items in the scale	4	4	4	4	4	4
Scale reliability: Cronbach's Alpha	0.75	0.86	0.79	0.87	0.89	0.87

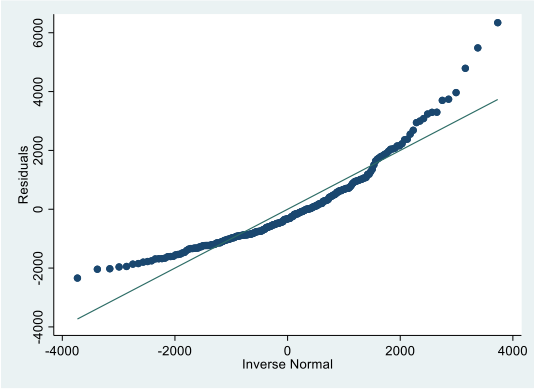
Appendix 6

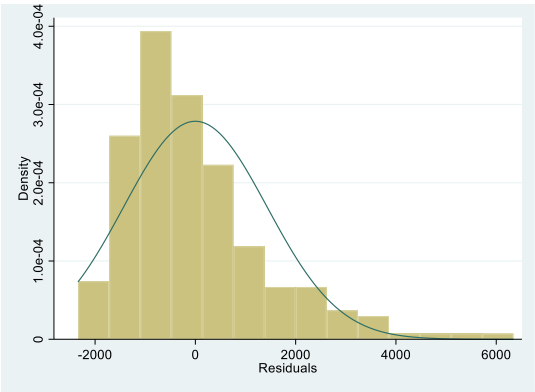
Table: Characteristics statistics of wearable activity trackers use.

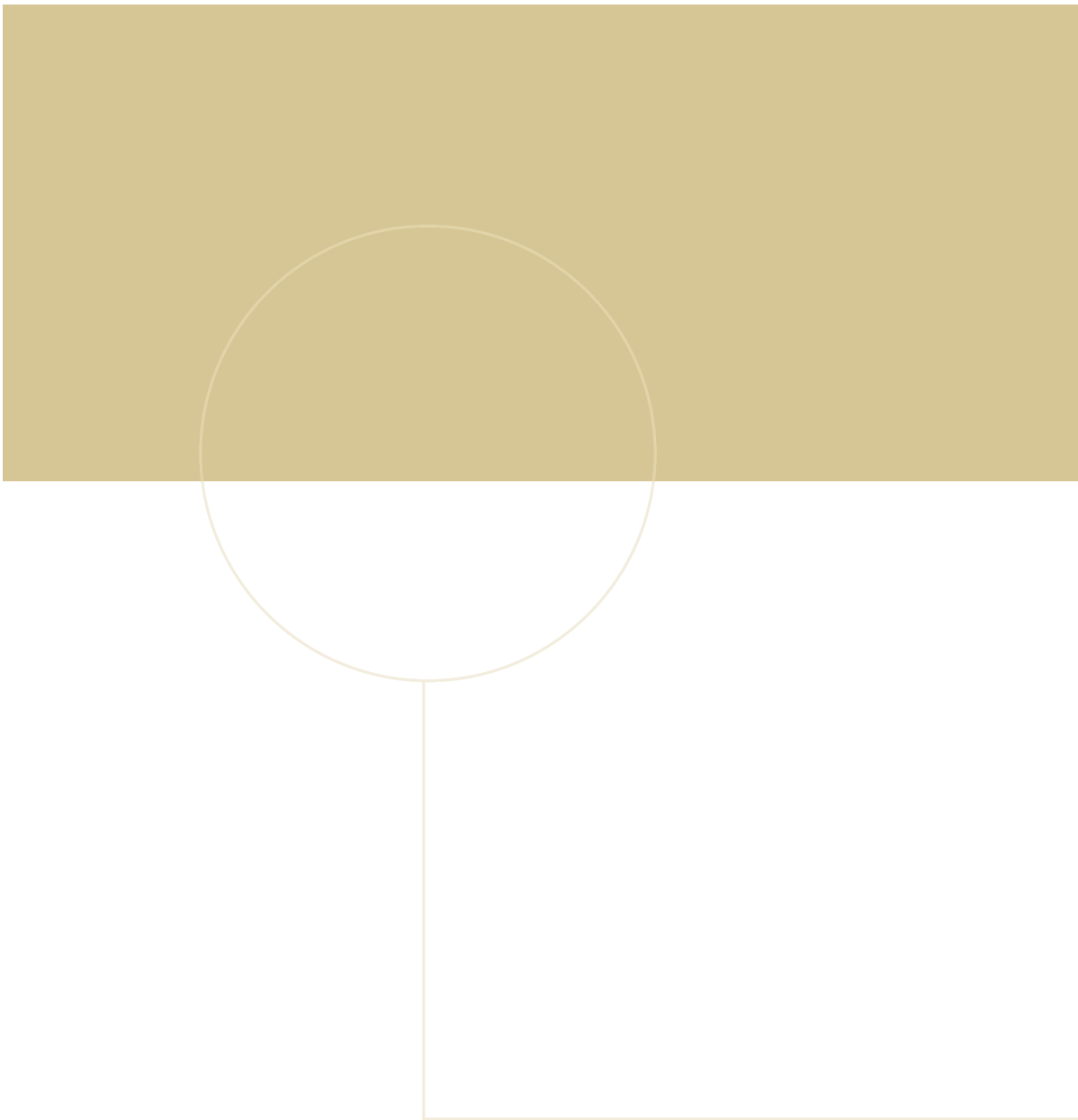
	Gender		
Use of WATs	Female	Male	Total
No	33	21	54
Used before	16	6	22
Yes	103	38	141
	152	65	217
Type			
Fitbit	14	2	16
Garmin	30	12	42
Polar	36	14	50
Apple Watch	18	6	24
Samsung Galaxy Watch	5	3	7
Xiaomi	0	0	0
Huawei	1	1	2
Annet	2	0	2
Duration			
Less than 6 months	8	1	9
6-12 months	9	2	11
1-5 years	47	24	71
5-10 years	31	7	38
More than 10 years	8	4	12
Expectation			
To a small degree	1	1	2
2	5	2	7
3	23	7	30
4	48	18	66
to a large degree	26	10	36
Use			
Daily activity	15	7	22
Exercise	14	6	20
Daily activity and exercise	74	25	99
Features			
Watch	94	33	127
Stopwatch	41	14	55
Step count	86	30	116
Pulse	90	33	123
Distance	79	29	108
Training history	74	23	97
Sleep pattern	66	19	85
Calorie	49	14	63
GPS	43	18	61
Blood pressure	6	3	9
Other	6	3	9

Appendix 7

The normal distribution (q-plot & histogram)







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