

**The Association between
Sedentary Behaviour and
State Emotional Exhaustion
in Higher Education
Students: An Experience
Sampling Study**

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Abstract

Purpose: Due to their academic schedule, higher education students are at special risk for Sedentary Behaviour. Simultaneously, they are vulnerable to Emotional Exhaustion, because of study related stressors and everyday hassles. Emotional Exhaustion is the core component of burnout, which about one third of higher education students encounter. This study explores the within- person association between Sedentary Behaviour and Emotional Exhaustion from both directions, while investigating whether more frequent Sedentary Breaks can reduce State Emotional Exhaustion in higher education students.

Methods: This study used an Experience- Sampling Method. A sample of higher education students ($M_{age} = 21.3$, $SD_{age} = 1.29$, female 33.33% and male 66.66%) was assessed repeatedly, over the course of eight days to assess how Sedentary Time, Sedentary Breaks and State Emotional Exhaustion naturally develop in relation to each other. A series of Linear Mixed Models was used to analyse the data. The association between Sedentary Time and Emotional Exhaustion was explored from both directions at the sample level and at the within-person level.

Result: The average, daily Sedentary Time in this study was 11.89 ($SD = 5.61$). The average score of State Emotional Exhaustion was 2.17 ($SD = 1.62$). Lastly, the sample took on average 5 Sedentary Breaks between assessments ($SD = 8$). The association between Sedentary Time and State Emotional Exhaustion was significant, weak and negative at the sample level (estimate = -0.007, $F(1, 134, 261) = 0.665$, $p = .416$) and at the within- person level (estimate = -0.103, $F(1, 83.129) = 11.108$, $p = .001$). Similarly, the association between Emotional Exhaustion and Sedentary Time was significant, weak and negative at the sample level (estimate = -0.111, $F(1, 460.85) = 1.558$, $p = .213$) and at the within- person level (estimate = -0.119, $F(1, 438.427) = 0.188$, $p = .190$). Sedentary Break slightly moderated the association between Sedentary Time and State Emotional Exhaustion, by reducing State Emotional Exhaustion (estimate = 0.019, $F(1, 323.80) = 0.817$, $p = .367$).

Conclusion: This study provides insights on the link between Sedentary Time and State Emotional Exhaustion in higher education students. Against expectations, increased Sedentary Time seemed beneficial in reducing State Emotional Exhaustion. Simultaneously, Increased State Emotional Exhaustion seemed beneficial as it decreased Sedentary Time. As these results are unexpected, future research should explore the mechanisms that might have reinforced these outcomes. In line with previous research, each additional Sedentary Break helped the participants decrease their State Emotional Exhaustion level.

Keywords: Sedentary Behaviour, Sedentary Breaks, Emotional Exhaustion, Burnout, Experience Sampling Method, Mental Health

Introduction

The rise of the Sedentary Lifestyle has been described as a major health problem of this century (Xu et al., 2020). Because of their academic schedule, higher education students are especially vulnerable towards Sedentary Behaviour (Castro et al., 2020). Emotional Exhaustion is a core component of burnout, which is experienced by about one third of higher education students during their studies (Meriläinen, 2014). While Emotional Exhaustion is maintained through multiple factors, there are no studies that explore whether excessive Sedentary Time is one of them. At the same time, it is possible that elevated State Emotional Exhaustion might lead to increases in Sedentary Time, for instance through feelings of fatigue (Salmela-Aro and Read, 2017). This study aims to explore the link between Sedentary Time and State Emotional Exhaustion from both directions, while investigating whether more frequent Sedentary Breaks can reduce State Emotional Exhaustion in higher education students. With the COVID-19 protective measures in effect, this study accompanies higher education students through their everyday life. In doing so, this study explores the potential pattern that underlies the emergence of Sedentary Time and Emotional Exhaustion in relation to each other.

Sedentary Behaviour

Sedentary Behaviour refers to any waking behaviour that includes sitting, reclining or laying, while the physical energy expenditure stays below ≤ 1.5 metabolic equivalents (METs) (Tremblay et al. 2017). Some examples of common Sedentary Behaviours include watching television, working in front of the computer or sitting while using a vehicle (Prince et al., 2020). In Western countries, prolonged sitting at work and during leisure time has integrated increased Sedentary Behaviour into the lifestyle of most people (Priskorn et al., 2016). While the two concepts can be related, Sedentary Behaviour is often falsely confused with physical inactivity. Here, it is important to clarify that Sedentary Behaviour and inactivity refer to different behaviours. To draw an example, if someone cycles to work for half an hour, that person has already met the daily physical activity guidelines (Van der Ploeg and Hillsdon, 2017). Nonetheless, if that same person spends a significant part of their remaining day in a Sedentary Position, the person is automatically at risk for the consequences of their Sedentary Behaviour, independent of how intense the previous activity session might have been (Patterson et al., 2018).

Sedentary Time was compared across Europe and the Netherlands stood out as a leading country. According to the results, 32.2% of the participants spent more than 7.5 hours in a Sedentary Position (Loyen et al., 2016). In a more recent study, the median time

Dutch participants spent in a sedentary position consisted of 9.1 hours on weekdays (Bakker et al., 2020). Further research then showed how some groups of the population are more vulnerable towards Sedentary Behaviour than others.

Sedentary Behaviour in Higher Education Students

Due to their academic schedule, students following a higher education show an increased susceptibility towards Sedentary Behaviour (Carballo-Fazanes et al., 2020; Mnich et al., 2019; Peterson et al., 2018.). In the Netherlands, higher education students spend approximately nine hours of their day in a Sedentary Position (Chim et al., 2021). Common Sedentary Behaviours among higher education students include spending time in class, studying, watching television, and doing computer work (Carballo- Fazanes et al., 2020; Deliens et al., 2015). While the Sedentary Time was already concerning to begin with, the COVID-19 related protective measures led to additional Sedentary Behaviour increases in higher education students. Reports indicate increases between 28.6% (Stockwell et al., 2021) and 52.7% (Rodríguez- Larrad et al., 2021). This is detrimental when considering the health implications.

Consequences of Sedentary Behaviour

To begin with the physical health problems, Sedentary Behaviour has been associated with obesity, insulin resistance, type 2 diabetes (Bowden Davies et al., 2018) and all- cause mortality (Loyen et al., 2019). In addition to physical health problems, research has consistently linked Sedentary Behaviour to negative mental health outcomes (Hallgren et al., 2019; Hamer et al., 2014). Common mental health problems include depression, anxiety and stress (Lee and Kim, 2019). Some of the pathways through which Sedentary Behaviour and mental health problems interact are social withdrawal (Gibson et al., 2017), increased screen time (Allen and Vella, 2015) and decreased self- confidence due to obesity (Hoare et al., 2016).

While Sedentary Behaviour is associated with mental health problems, it needs to be considered that mental health problems can also be associated with Sedentary Behaviour (Diamond and Byrd, 2020). This implies that people who have certain mental health problems might feel inclined to engage in more Sedentary Time. For this reason, the association is thought to be bidirectional.

Emotional Exhaustion in Higher Education Students

One specific mental health outcome that might be related to Sedentary Behaviour in higher education students is Emotional Exhaustion. Emotional Exhaustion is a core component of burnout (Arens and Morin, 2016), which about one third of university students encounter in their studies (Meriläinen, 2014). Current understanding of burnout views the

condition as a process rather than the experience of isolated symptoms (Rosenberg and Pace, 2006). In the burnout development process, Emotional Exhaustion is the first stage to emerge (Demirci et al., 2010). Emotional exhaustion is defined as a feeling of tiredness, fatigue, a lack of energy and a depletion of emotional resources (Rigg et al., 2013). After Emotional Exhaustion, a stage of depersonalisation begins to set in, characterised by the cultivation of cynicism. Lastly, feelings of low personal accomplishment emerge (Rigg et al., 2013). Out of the three stages through which burnout develops, Emotional Exhaustion is thought to be the most critical (Arens and Morin, 2016). Since Emotional Exhaustion emerges as the first condition, it acts like an entry point into the burnout syndrome, which enables the emergence of the remaining two stages (Schonfeld et al., 2019). For this reason, Emotional Exhaustion is thought to be the most critical stage (Arens and Morin, 2016).

Higher education students experience Emotional Exhaustion for individual reasons. Some of them include the fear of failure, time strain, financial uncertainties and the attempt to balance out school and personal life (Boren, 2013). Burnout severely affects students, as it can lead to hopelessness, anxiety, isolation, depression and even suicidal ideation (Rosenberg and Pace, 2006). In response to the associated negative feelings, Emotional Exhaustion indicates the point at which most students start to consider leaving academia (Devine and Hunter, 2016).

Sedentary Behaviour and Emotional Exhaustion

Currently, there are no studies that explicitly explore the link between Sedentary Behaviour and Emotional Exhaustion in higher education students. The existing research mostly focuses on Sedentary Behaviour and Emotional Exhaustion in other target groups. As an example, a study by Socaciu et al. (2020) found a correlation between Sedentary Behaviour and Emotional Exhaustion in a sample of nursing professionals. Next, a study by Ekstedt and Fagerberg (2005) identified the lifestyle- choices participants made, during the burnout development period. About 70% of participants were following a Sedentary Lifestyle at the time at which burnout, and therefore Emotional Exhaustion, developed. Since the study did not specifically focus on exploring the potential link between Sedentary Behaviour and Emotional Exhaustion, the question remains whether the two variables were present by chance or whether there is a more systematic relation. With these findings at hand, it seems promising to extend the exploration of Sedentary Behaviour and Emotional Exhaustion towards higher education students.

Emotional Exhaustion and Sedentary Behaviour

Previous studies found that people with mental health problems might feel more inclined to engage in high volumes of Sedentary Behaviour (Teychenne et al., 2014). In a

study on Sedentary Behaviour and Depression, Teychenne et al. (2014) found that more depressed participants became increasingly Sedentary by watching television, presumably to escape their negative emotions. The question arises whether State Emotional Exhaustion similarly increases Sedentary Behaviour, for example through symptoms such as chronic fatigue (Salmela-Aro and Read, 2017). If this is the case, then Sedentary Behaviour might be an intuitive coping mechanism for those affected, as it might provide them with a moment of rest.

Sedentary Breaks

The impact of Sedentary Behaviour can be better understood, when considering the mental health benefits of interrupting it more frequently. Sedentary Breaks are defined as the act of moving from a seated or declining position to an upright posture (Hallgren et al., 2020). Hallgren and colleagues (2020) observed mental health benefits of Sedentary Breaks in participants who were dealing with depression and anxiety. This protective effect was also evident in a sample of participants dealing with fatigue (Wennberg et al., 2016). Lastly, Giurgiu et al. (2019) found that frequent Sedentary Breaks significantly helped participants improve their mood. With no studies on Sedentary Breaks and Emotional Exhaustion, the question whether people suffering from Emotional Exhaustion can similarly benefit from Sedentary Breaks remains.

Currently, not much is known about the mechanisms that lead from Sedentary Breaks to mental health improvements. However, the resulting increases in cerebral blood flow are suggested to play a protective role (Carter et al., 2016). Optimal cerebral blood flow is important as it is associated with crucial markers of mental health, such as cognitive functioning (Carter et al, 2016). Given that Sedentary Behaviour is associated with State Emotional Exhaustion in higher education students, Sedentary Breaks could perhaps be used to decrease State Emotional Exhaustion.

Experience Sampling

Experience Sampling Methods (ESM) is a study design, known for resulting in ecologically valid and reliable data (Napa Scollon et al., 2009). While global self-reports assess variables at one specific time, experience sampling studies repeatedly conduct assessments while the participants naturally go about their everyday life (Christensen et al., 2003). The variables of interest are therefore assessed as they realistically develop in response to the participants' real life (Myin-Germeys et al, 2018). The frequent, repeated measurements that are typical for the Experience Sampling Method help overcome the retrospective recall bias and therein reduce the occurrence of inaccurate answers (Barrett and Barrett, 2001; Myin-Germeys et al, 2018). Moreover, data obtained through repeated daily measurements is suitable for studying not only between person processes but also

within- person processes, as participants can be compared to themselves by using data from different measurement moments (Scollon et al., 2009). To conclude, the characteristics of the Experience Sampling Method seem excellent for the purpose of investigating how Sedentary Behaviour and Emotional Exhaustion might relate to each other in the real life context.

The current Study

Until now, Sedentary Behaviour and State Emotional Exhaustion were not explored by focussing on a potential link in higher education students. Based on the significance that Sedentary Behaviour and Emotional Exhaustion have for this target group, this study aims to explore the association between the two variables. For this purpose, this study will use an Experience- Sampling design. Apart from contributing to scientific insights about Sedentary Behaviour and Mental Health, the current study hopes to inform future interventions that are specifically tailored towards improving the mental health of students following a higher education.

For the current study, the following research questions were formulated.

RQ1: What is the association between Sedentary Behaviour and Emotional Exhaustion in higher education students?

RQ2: What role do Sedentary Breaks play in the relationship between Sedentary behaviour and Emotional Exhaustion in higher education students?

By taking advantage of the extensive data obtained through the Experience Sampling Method, the first research question will be answered on two levels. First, the association between Sedentary Behaviour and Emotional Exhaustion will be explored from both directions with respect to the sample as a whole. Second, the research question will be answered on the within- participant level, by exploring how the link between Sedentary Behaviour and Emotional Exhaustion develops in each participant on different days.

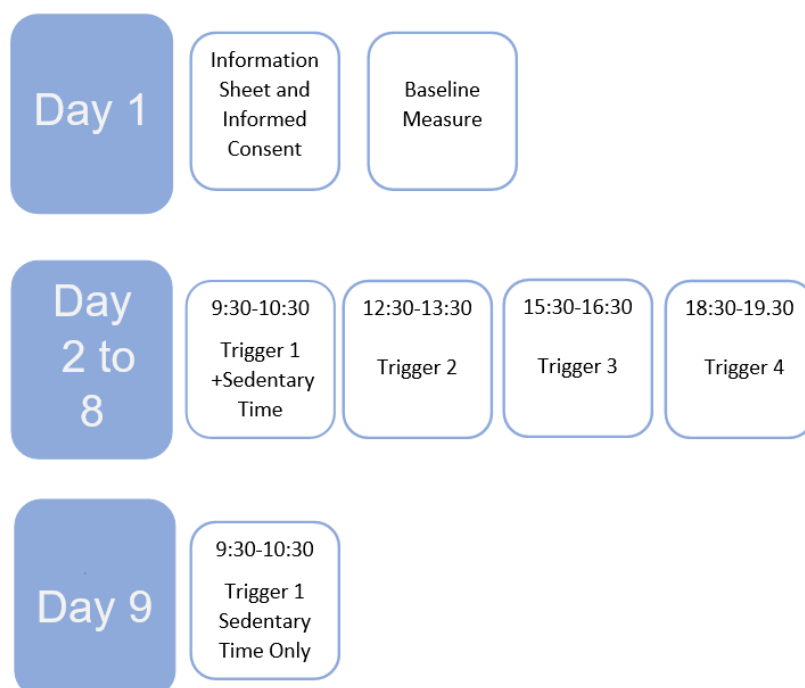
Methods

Design

To answer the research questions, an Experience Sampling Method was used. In line with the Experience Sampling Method, the assessments of Sedentary Behaviour, Emotional Exhaustion and Sedentary Breaks were implemented repeatedly into each study day. By integrating the assessments into the natural day- to- day- context of the participants, the researcher could observe the naturally occurring fluctuations in Sedentary Behaviour, Emotional Exhaustion and Sedentary Breaks over time (Barner, 2013). Since about 90% of people carry their smartphone with them throughout the day, Ethica was used to carry out the data collection (Thai & Page- Goud, 2017). In doing so, the participants could flexibly access each assessment through their smartphone, independent of their current location.

The data collection took place from 12.04.2021 to 11.05.2021. The individual study duration was nine days and it started on the day participants joined the study. The first day was used to receive informed consent, to collect demographic information about the participants and to establish baseline measures of Emotional Exhaustion. The following seven days were used to conduct the daily assessments. More specifically, Emotional Exhaustion and Sedentary Breaks were assessed four times per day: once in the morning between 09:00 and 10:00, once in the noon between 12:30 and 13:30, once in the afternoon between 15:30 and 16:30 and once in the evening between 18:30 and 19:30. Sedentary Behaviour was assessed once each day, as part of the morning questionnaire.

Initially, the individual study duration was decided to consist of seven days. Since each Sedentary Time assessment referred to the Sedentary Behaviour of the previous day, a ninth day was later added to the study to ensure an assessment of Sedentary Time on day eight. This decision was made halfway throughout the study, at a time at which around half of the participants already finished their participation. To ensure that these participants did not have one less data point than the participants who already finished participation, they were assigned an additional data point, which consisted of the average Sedentary Time of the previous six study days. Once the initial design of the study was finalized, a pilot study was conducted with three undergraduate students. On behalf of their advice, the questionnaire availability was extended, from half an hour to one hour to increase the response rate. After the study received ethical approval from the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente (Request- Nr.: 210334), it was ready to be published.

Figure 1*Data Collection Time Plan***Participants**

Prior to the recruitment of the participants, some inclusion criteria were defined. To begin with, participants had to be at least 18 years old. Additionally, they had to be following a higher education and they had to be proficient in the English language. To access the Ethica application, the participants had to own an Android or iOS- device. For the recruitment of participants, a convenience sampling strategy was employed by using SONA Systems, a recruitment website of the University of Twente. In addition, participants were directly asked to participate through social networks.

Initially, 37 participants joined the study. The final sample consisted of 27 participants. The average age of the final study sample ranged from 21 years to 26 years ($M_{age} = 21.3$, $SD_{age} = 1.29$, female 33.33% and male 66.66%). The nationalities were German (51.4%), Dutch (37.8%), and other (10.8%).

Materials***Ethica***

Various materials were involved in this study. To begin with, this study was part of a joint project with other researchers. In total, the participants were assessed on Demographics, Sedentary Behaviour, Sedentary Breaks, Fatigue and State Emotional Exhaustion (Appendix A). This following section will focus on the materials that were relevant for this specific study only. First, Ethica was used to create and publish the assessment questionnaires. Ethica is an

online based end- to end platform that provides researchers with necessary features for the Experience Sampling Method, such as frequent time triggers. Next to that, Ethica can be used to send out notifications to remind the participants to respond to the assessments.

Information Sheet and Informed Consent Form

The information sheet described the goal of the study and the activities that were expected from the participants, such as responding to repeated, daily assessments (Appendix B). Moreover, the information sheet assured the participants of their anonymity and included information about potential risks. Next, it entailed an explanation of the participants' right to opt out of the study at any point without explanation. Lastly, an informed consent form was included in the information sheet. It consisted of six items that assessed whether the participants understood and consented with the nature of the study, followed by a question about whether they were consenting to participate. Each item was followed by the response options “Yes” and “No”.

Trait Emotional Exhaustion

To assess trait levels of Emotional Exhaustion, the Emotional Exhaustion subscale from the Maslach Burnout Inventory- Student Survey (MBI-SS) was used. The assessment was created by Schaufeli et al. (2002). Originally, the five items are rated on a seven- point Likert Scale, ranging from “Never” to “Everyday” (Schaufeli et al., 2002). To fit the purpose of this study, the Likert- Scale was adapted to range from 0 “Strongly Disagree” to 6 “Strongly Agree”. In doing so, the response options were in line with the State Emotional Exhaustion assessments. This enabled the researcher to later compare the scores. The level of Emotional Exhaustion is estimated by estimating arithmetic means and then using upper and lower quartiles to categorise the score (Gálan et al., 2011). A score of ≤ 1.2 indicates low levels of Emotional Exhaustion while a score of ≥ 2.8 indicates high levels of Emotional Exhaustion. Lastly, average levels of Emotional Exhaustion are indicated by scores between 1.3 and 2.7 (Brenninkmeijer and VanYperen, 2003). In the current study, the scale has an internal consistency of $\alpha = .89$. The validity has been proven in a sample of European university students (Porthogese et al., 2018). Overall, the Emotional Exhaustion subscale of the MBI-SS subscales is recommended for usage of students in higher academic contexts (Pérez-Mármol and Brown, 2019).

Daily Sedentary Time

The item for the assessment of Sedentary Time, is an adapted version of an item originally used by Atkin et. al. (2012). The original item required the participants to estimate their daily sitting time on each study day, before their bedtime. Atkin and colleagues (2012) compared self- reports using this item to Sedentary Time measured with an accelerometer,

which resulted in moderate reliability and correlation. In doing so, the item was validated as a satisfactory self-report tool for measuring Sedentary Time. Since the current study concerns all aspects of Sedentary Time and not just sitting time, the item was adapted to “How many hours did you approximately spend sitting or lying down in the last 24 hours?”. By having the item refer to the entire 24 hours since the last measurement, it was ensured that no time frame is left unreported by the participants. By not specifying on certain time frames, the item is inclusive to participants who spend different timepoints of the day being awake or asleep. Thereby, the individual differences in Sedentary Behaviour are considered.

Sedentary Breaks

To measure the frequency of Sedentary Breaks, an adaptation of an item previously used by Clark et al. (2011) was chosen. The original item is “How many breaks from sitting (such as standing up or stretching or taking a short walk) during one hour of sitting would you typically take at work?”. To fit the momentary assessments of the current study, the original item was edited to “Since the last measurement, how many times did you break up your Sedentary Behaviour?”. The original item showed a significant correlation between self-reported breaks in Sedentary Time and accelerometer-derived breaks in a sample consisting of adults (Clark et al., 2011). The Spearman's Rank Correlation Coefficient is $r_s = 0.26$ (Clark et al., 2011). This indicates a weak but significant positive correlation between self-reports and objective measures.

State Emotional Exhaustion

For the momentary assessment of Emotional Exhaustion, the same assessment tool as for Trait Emotional Exhaustion was used, namely the Maslach Burnout Inventory- Student Survey. For the purpose of specifically assessing State Emotional Exhaustion, the subscale was edited more extensively. As a first adaptation to the original scale, three out of five items were chosen for assessing State Emotional Exhaustion in this study. These items are “I feel emotionally drained by my studies”, “I feel burned out from my studies” and “Studying or attending a class is really a strain for me”. The reason the original scale was shortened is because the remaining two items (“I feel used up at the end of a day at school” and “I feel tired when I get up in the morning and have to face another day at school”) directly refer to the beginning and the end of the day. Therefore, they are not suitable for the Experience Sampling Method, as the nature of the Experience Sampling Method is about using repeated assessments at various points of the day (Verhagen et al., 2016). As in the original scale, the items were rated on a seven-point Likert scale. This preserves the sufficiently large number of response options and increases variance in responses (Fisher and To, 2012). An additional change to the original questionnaire is the reformulation of the titles given to the Likert-Scale-response options. Originally, the seven-point Likert Scale ranges from “Never” (0) to

“Everyday” (6) (Chim et al., 2020). These response options are not in line with repeated daily measurements, as they refer to non- daily time frames. Therefore, the items were adapted to range from Strongly Disagree (0) to Strongly Agree (6). As mentioned in the description of the trait measure of Emotional Exhaustion, the original subscale has been validated for the usage amongst higher education students. For this study, the scale has an internal consistency of $\alpha=.94$. Since no tools are available to measure State Emotional Exhaustion, this study had to rely on the adaptation of tools that already exist, such as the Maslach- Burnout Inventory- Student Survey.

Procedure

Once the participants decided to join the study, they were asked to install the Ethica application on a suitable device in order to register for the study. For a successful registration, the participants were provided with a study ID as well as an alternative online link and a QR code. Hence, the participants could choose how to initiate their enrollment. Next, to be eligible for the study participation, the participants had to provide their active informed consent via Ethica. To make the participants aware about what they were giving their consent to, they received an information sheet. After reading it, the participants had to actively respond with “Yes” to seven statements, which were formulated to make sure that the participants understood and agreed with the nature of the study. Once this step was completed, Ethica gave each participant an ID number under which their answers were saved. After the successful study enrolment, the data collection started, and the participants were provided with the baseline questionnaire on the application. Next, the participants were provided with an assessment questionnaire to establish Trait Emotional Exhaustion levels. Once this step was accomplished, the participants successfully completed their first study day.

In the following seven days, the participants had to respond to four daily, repeated assessment questionnaires, which they were provided with through the Ethica application. Each assessment took the participants about five minutes to complete. On each study day, the assessment questionnaires were made available at around the same times, therefore the participants could estimate when to expect them. In addition, the participants received a notification from Ethica as a reminder, once it was time to fill out each assessment questionnaire. After their participation period was over, the participants were thanked for their effort through Ethica and they were once more provided with the researchers contact details for the case that any study- related questions came up.

Analysis

Before analysing the data, the questionnaires were downloaded from Ethica and imported to Excel as five separate data files. Next, the data was cleaned. To begin with, participants who completed less than 50% of the measurements were excluded from the data set (Mehl and Conner, 2012). After that, mean scores for the Trait Emotional Exhaustion and each repeated measure of State Emotional Exhaustion were calculated (Obregon et al., 2020). After preparing all five Excel data files, the files with the demographic and the baseline responses were merged into one SPSS data set, while the Excel files with the state measures of Sedentary Behaviour, Emotional Exhaustion and Sedentary Breaks were merged into a second SPSS data set. This separation took place to have the time point variable refer to the state measurements. Each of the two datasets was then analysed separately.

Data analysis took place using IBM SPSS Statistics (Version 25). To begin with, the demographic information and baseline measures were analysed using descriptive statistics. Depending on the variable, they were presented as means and frequencies. Next, to estimate the internal reliability of the Trait and State Emotional Exhaustion assessments, Cronbach's alpha was calculated for both variables. After this, the daily, repeated measurements were analysed. First, a "timepoint" variable for each repeated measurement was created to achieve a clear impression over each variable's developments in time. Since during the data collection the Sedentary Time assessment referred to the previous day, while State measures referred to the current moment, all State measure responses were lagged.

Next, to answer the research questions, a series of Linear Mixed Models was created. The Linear Mixed Model was used for the analysis because it can deal with missing data points, while accounting for the nested structure of the data (Magezi, 2015). Moreover, Linear Mixed Models can account for fixed and random variables, which is relevant for the data analysis in experience sampling studies (West, 2009). As a further advantage, the Linear Mixed Model can disaggregate the hierarchical structure underlying within- person and between- person level associations (Hoffmann and Stawski, 2009). While this study did not assess between- person associations, it still used multiple levels, by disaggregating the data on the sample level and on the within- person level. For all models, "ID" was set as the subject variable, "Time point" was used as the repeated, fixed variable and AR (1) was used as the Repeated Covariance Type to analyse the nested structure of the longitudinal data. By using the Linear Mixed Model, the Estimated Marginal Means of Sedentary Time, Emotional Exhaustion and Sedentary Breaks were calculated. Each variable was visualized in a figure against the participant ID. Sedentary Time and State Emotional Exhaustion were additionally visualized against the time point variable.

First Research Question

For the first research question, a Linear Mixed Model was created to explore whether a correlation exists between Sedentary Time and Emotional Exhaustion on the sample level. Therefore, Emotional Exhaustion was set as the dependent variable and Sedentary Behaviour was set as the random covariate. Next, the correlation between Emotional Exhaustion as the independent variable and Sedentary Behaviour as the dependent variable was explored. Here, Emotional Exhaustion was set as the fixed, Covariate and Sedentary Time was set as the dependent variable.

The next two linear mixed models were created to explore the within- person association between Sedentary Time and Emotional Exhaustion from both directions. In doing so, it was estimated whether participants felt more Emotional Exhaustion on the days on which they were Sedentary for a longer time, followed by whether participants were more Sedentary during the days in which they experienced more Emotional Exhaustion. As a first step, person- mean centred scores were calculated for Sedentary Time and Emotional Exhaustion (Curran& Bauer, 2011). For the first Linear Mixed Model, the person- mean centred score of Sedentary Time was set as the fixed Covariate and Emotional Exhaustion was set as the dependent variable. For the second Linear Mixed Model, the person- mean centred score of Emotional Exhaustion was set as the fixed Covariate and Sedentary Behaviour was set as the dependent variable.

Second Research Question

The last Linear Mixed Model was created with the goal of exploring whether Sedentary Breaks moderate the hypothesized relationship between Sedentary Behaviour and Emotional Exhaustion. For this analysis, Sedentary Behaviour*Sedentary Breaks was chosen as the fixed Covariate and Emotional Exhaustion was chosen as the dependent variable.

Results

Initially, 37 participants signed up for this study. Since eight participants answered less than 50% of the assessments, they were excluded from the final study sample. This resulted in a sample size of $N=27$.

Descriptive Information

Table 1 summarizes the descriptive statistics of the final study sample as well as the Trait of Emotional Exhaustion, which refers to the two weeks before the study participation. During this study, the participants spent on average 11.89 hours per day in a Sedentary Position ($SD=5.61$). The mean level of Emotional Exhaustion was 2.17 ($SD= 1.62$). With a possible range between 0-6, the score of 2.17 is neither considered low or high, as it refers to an average level of Emotional Exhaustion. Compared to the levels of State Emotional

Exhaustion, the participants experienced more elevated Emotional Exhaustion in the two weeks preceding their study participation. With a mean of 3.02 ($SD= 1.34$), the average Trait Emotional Exhaustion of this sample is considered high. Looking at the average amount of Sedentary Breaks during this study, the participants interrupted their Sedentary Behaviour 5 times between measurements ($SD= 8$).

Table 1.
Mean, Standard Deviation and Median of Sedentary Behaviour, Sedentary Breaks, Trait Emotional Exhaustion and State Emotional Exhaustion.

Variable	Mean	SD	Median	N
Sedentary Time	11.89	5.16	12.00	27
Sedentary Breaks	5.43	8	4	27
Trait EE	3.03	1.34	2.80	27
State EE	2.17	1.62	2.00	27

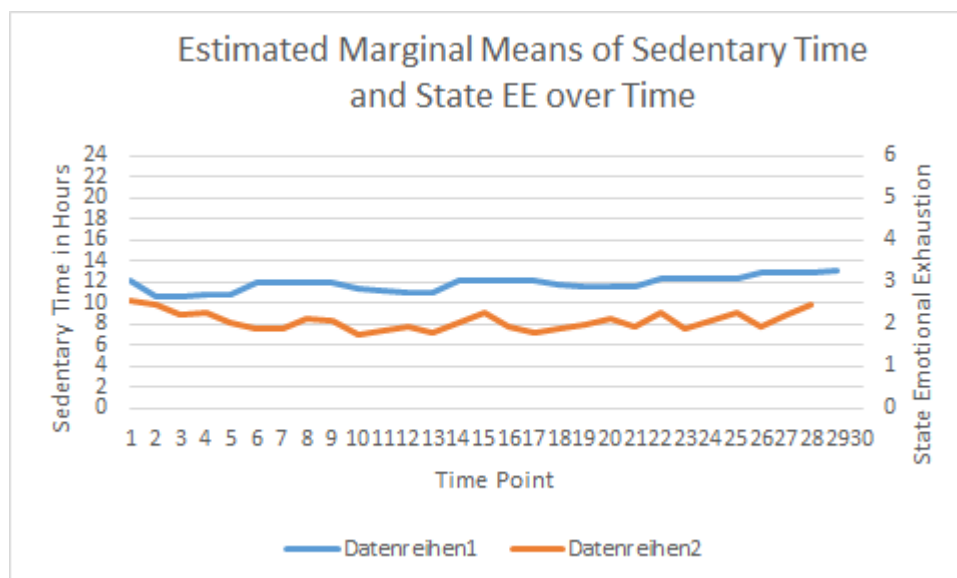
Note. Levels of Trait and State Emotional Exhaustion can range between 0 and 6. N=27.

Estimated Marginal Means

Figure 1 shows how this sample's average Sedentary Time and average State Emotional Exhaustion developed in relation to each over the course of this study. The assessment of Sedentary Time started on the second study day, which is represented by Time Point one and it finished on the ninth study day, represented by Time Point 30. Each Sedentary Time assessment was answered with reference to the past 24 hours. State Emotional Exhaustion was always assessed with reference to the current moment, starting on the second study day and ending on the eighth study day. With 13.09 average hours spent in a Sedentary Position, the sample scored the highest during Time Point 30. The samples average Sedentary Time was the lowest during Time Point four, with 10.64 hours spent in a Sedentary Position. The sample showed the highest average State Emotional Exhaustion score during Time Point 3 with a mean of 2.57, while the lowest Emotional Exhaustion score was observed during Time Point 12 with a mean of 1.77.

Figure 1

Estimated Marginal Means of Sedentary Time and State Emotional Exhaustion over time



Note. N=27.

Figure 2 shows the Estimated Marginal Means of Sedentary Time as indicated by the 27 participants, respectively. A majority of 59.26% of participants (N=16) spent on average >10 hours a day in a Sedentary Position. Next, 25.93% of participants (N=16) spent on average >15 hours a day in a Sedentary Position. The highest daily, average daily Sedentary Time is 19.83 hours (SD=1.08), which was indicated by the participant #38769. The lowest average of daily Sedentary Time was reported by the participant #39159 with 3.01 hours (SD=1.46).

Figure 2

The mean daily Sedentary Time, as indicated by each participant, respectively.

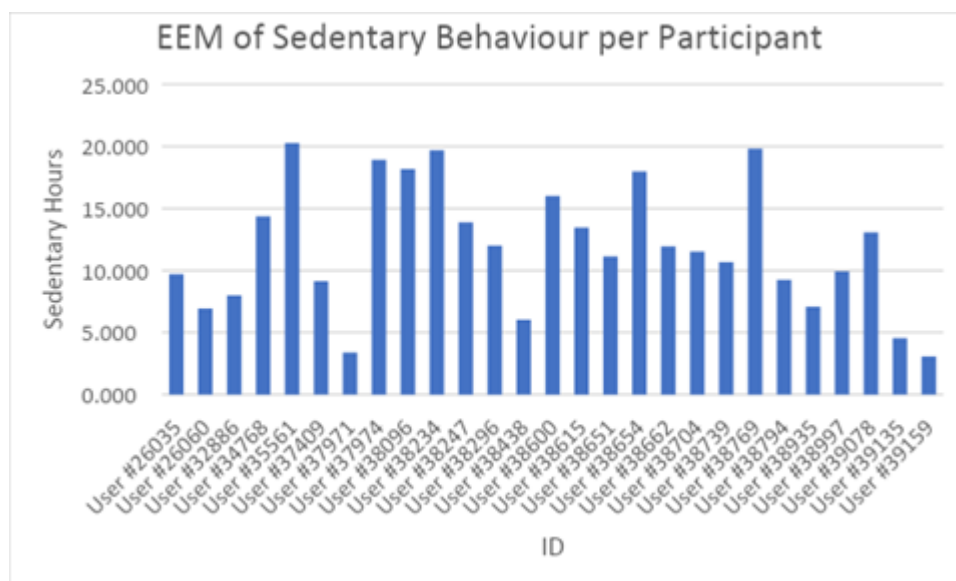
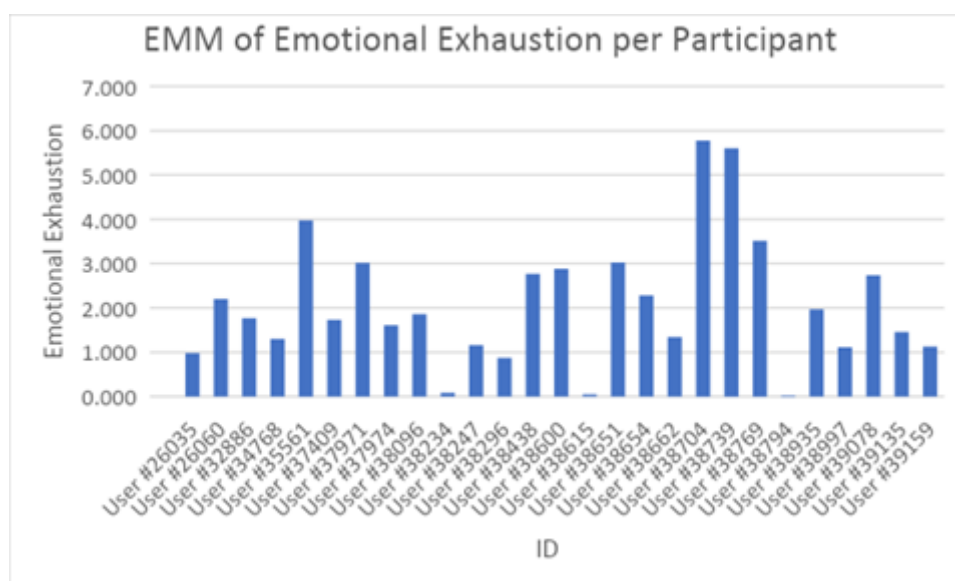


Figure 4 visualizes each participant's Estimated Marginal Mean score of State Emotional Exhaustion in between measurements. To estimate the level of Emotional Exhaustion, the cut-off scores from Brenninkmeijer and VanYperen (2003) are used (≤ 1.2 = low Emotional Exhaustion; ≥ 1.3 and ≤ 2.7 = average Emotional Exhaustion; ≥ 2.8 = high Emotional Exhaustion). In total 29.62% of participants ($N=8$) indicated mostly low levels of Emotional Exhaustion. A majority of 44.44% of participants ($N=12$) reported mostly average levels of Emotional Exhaustion. Lastly, a minority of 25.93% of participants ($N=7$) indicated on average high levels of Emotional Exhaustion. With an average of 5.77, participant #38704 displays the highest mean level of Emotional Exhaustion. On the contrary, participant #38794 shows the lowest average level of Emotional Exhaustion with a mean of 0.02.

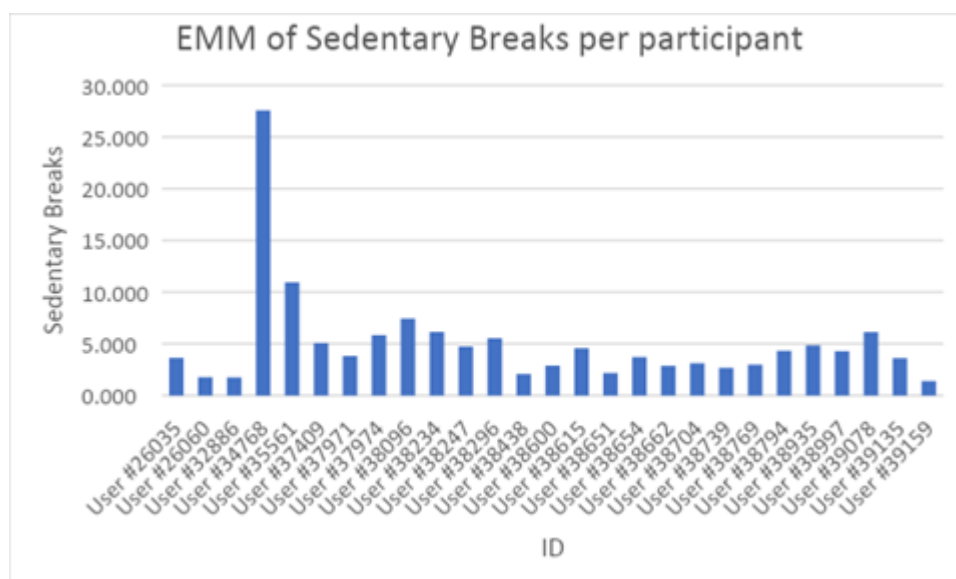
Figure 3

The mean State Emotional Exhaustion between measurements, as indicated by each participant respectively.



Note. Emotional Exhaustion can range between 0-6.

The Estimated Marginal Means of each participant's Sedentary Break frequency between measurements are displayed in Figure 6. Comparing participants, the highest frequency of Sedentary Breaks between measurements was indicated by participant #34768 ($M= 24.78$). The lowest frequency of Sedentary Breaks between measurements was indicated by participant #39159 ($M=1.54$). Looking at figure 6, the frequency of Sedentary Breaks of participant #34768 is exceptionally high. This becomes clear when comparing the participant's score to the sample mean of $M= 5.43$ ($SD=8$). Therefore, when excluding participant #39158, the Estimated Marginal Means of Sedentary Break frequency range from 1.54 to 13.10.



Linear Mixed Model Analysis

First Research Question

To answer the research questions, a series of Linear Mixed Models was used. The first research question was formulated to explore the association between Sedentary Behaviour and Emotional Exhaustion. The Linear Mixed Model analysis revealed a weak, negative but significant association between Sedentary Time in hours as the fixed covariate and State Emotional Exhaustion as the dependent variable ($estimate = -0.007$, $F(1, 134, 261) = 0.665$, $p = .416$). Therefore, with every additional hour spent in a Sedentary Position, the State Emotional Exhaustion levels of the participants slightly decreased. When investigating the association from the other direction by setting Emotional Exhaustion as the fixed Covariate, and Sedentary Time as the dependent variable, results show a weak, negative and significant association ($estimate - 0.111$, $F(1, 460.85) = 1.558$, $p = .213$). In other words, as State Emotional Exhaustion increased, the participants became slightly less Sedentary.

Next, the within- participant association between Sedentary Time and Emotional Exhaustion was analysed from both directions. When setting the person- mean centred score of Sedentary Time as the fixed Covariate and State Emotional Exhaustion as the dependent variable, the result shows a significant, weak and negative ($estimate - .103$, $F(1, 83.129) = 11.108$, $p = .001$). This indicates, the participants felt less State Emotional Exhaustion on the days on which they spent more hours in a Sedentary Position. To explore the association from the other direction, the person- mean centred score of Emotional Exhaustion was used as the fixed Covariate with Sedentary Behaviour being the dependent variable. The association is significant, weak and negative ($estimate - 0.119$, $F(1, 438.427) = 0.188$, $p = .190$). Therefore, participants spent less Time in a Sedentary Position on the days on which State Emotional Exhaustion was felt more intensely.

Second Research Question

To answer the second research question, a moderator-analysis was performed. Sedentary Time was set as the fixed Covariate, Sedentary Breaks were set as the moderator variable and State Emotional Exhaustion was the dependent variable. The association is

negative, weak and significant (*estimate* -0.019, $F(1, 323.80) = 0.817$, $p = .367$). This indicates, with each additional Sedentary Break between measurements, participants experienced lower levels of State Emotional Exhaustion.

Discussion

The current study was initiated, to explore whether increased Sedentary Behaviour puts higher education students at risk for suffering elevated levels of State Emotional Exhaustion. In line with that, this study investigated whether higher education students spend more time in a Sedentary Position on the days on which State Emotional Exhaustion increases. Lastly, it was explored whether higher education students can actively lower their State Emotional Exhaustion by integrating more frequent Sedentary Breaks into their Sedentary Behaviour. Against expectations, State Emotional Exhaustion showed slight decreases instead of increases with every additional hour participants spent in a Sedentary Position. Similarly, Sedentary Time slightly decreased on the days on which the participants felt more elevated State Emotional Exhaustion. As expected, Sedentary Breaks seemed to be beneficial for the participants mental wellbeing, as they slightly decreased State Emotional Exhaustion levels. While the outcomes were significant, it is important to note that the effect sizes were rather weak.

Characteristics of Sedentary Behaviour, Emotional Exhaustion and Sedentary Breaks

The students in this sample displayed an average, daily Sedentary Time of 11.89 hours while taking an average of 5.43 breaks between measurements. With this outcome, the current sample surpasses previous student samples with three additional hours spent in a Sedentary Position (Chim et al., 2020). These comparatively high volumes of Sedentary Behaviour could be a result of inaccurate participant responses due to a recall bias. This is likely the case, when considering that this study used only one daily Sedentary Behaviour assessment, which required participants to recall the last 24 hours. Instead of relying on self-report measures, Chim et al. (2020) used accelerometers to track Sedentary Behaviour, which likely lead to more accurate data. Apart from methodological reasons, this study's high average Sedentary Time could underlie other explanations. The high volumes of Sedentary Behaviour might have been influenced by the COVID-19 regulations, which confined the participants to their home during the data collection period. This would be in line with previous studies, which report Sedentary Behaviour increases of 28.6% (Stockwell et al., 2021) to 52.7% (Rodríguez- Larrad et. al, 2021) in response to the stay- at- home measures.

Next, while there were individual variations, the overall level of Emotional

Exhaustion was “average” ($M=2.17$), when compared to a sample of undergraduate students (Gálan et al., 2011). In the current sample, 45% of participants experienced on average moderate levels of State Emotional Exhaustion, 30% of participants experienced mostly average levels of State Emotional Exhaustion and 25% of participants experienced on average high levels of State Emotional Exhaustion. This result is not completely in line with previous findings, which indicate that about one third of higher education students are affected by intense Emotional Exhaustion (Meriläinen, 2014). Again, this diversion could be first explained with methodological study reasons. To begin with, the Emotional Exhaustion-subscale for the state measurements in this study was extensively adapted from its original version. Consequently, the sensitivity of the subscale might have decreased, which likely impaired the detection of State Emotional Exhaustion. With an average score of 3.03 for Trait Emotional Exhaustion, the sample clearly experienced more Emotional Exhaustion in the two weeks preceding the study. Although the Maslach Burnout Inventory- Student Survey was used for measuring both Trait and State Emotional Exhaustion, the scale for Trait Emotional Exhaustion was edited to a far lesser extent. Consequently, the baseline tool was closer to the original questionnaire than the state measure, which more likely preserved its sensitivity. There are also personal, participant- specific explanations for the low prevalence of high Emotional Exhaustion. In general, the occurrence of Emotional Exhaustion is a response to ongoing academic and personal stressors such as exam pressure, change of address and lack of interpersonal relationships (Aguayo et al., 2019). It is possible that the data collection took place in a period in which most participants were free of such strain. In hindsight, the current study duration of nine days might have been too short to ensure the occurrence of events that trigger spikes in Emotional Exhaustion. Therefore, Emotional Exhaustion might be less dynamic over time than assumed.

The association between Sedentary Behaviour and Emotional Exhaustion

Against expectations, levels of State Emotional Exhaustion did not increase when participants increased their daily Sedentary Time. Instead, State Emotional Exhaustion decreased in intensity with every additional hour the participants spent in a Sedentary Position. This result might have occurred based on several reasons. The current study did not control whether the participants were mentally active or mentally passive while being Sedentary. For depression, it was found that not all types of Sedentary Behaviour are associated with increased mental health problems. While mentally- passive Sedentary Behaviour, such as TV-viewing, led to increases in depression symptoms, mentally active Sedentary Behaviours, such as desk- based work, led to a decrease in mental health problems (Hallgren et al., 2020). Considering that the participants in this study were students, it seems reasonable to assume that a significant time of their Sedentary Behaviour might have been spent on mentally- active Sedentary Activities, such as studying. With

Emotional Exhaustion being correlated to depression (Schonfeld et al., 2020), it is possible that increases in State Emotional Exhaustion are similarly bound to mentally- passive Sedentary Activities.

The association between Emotional Exhaustion and Sedentary Behaviour

In this study, the participants spent slightly less time in a Sedentary Position, when levels of State Emotional Exhaustion increased. Previous research hypothesized that individuals with mental health problems might engage in more Sedentary Behaviour (Teychenne et al., 2014). In the current study however, participants spent less time in a Sedentary Position, the more their Emotional Exhaustion levels increased. Although Sedentary Time only slightly decreased with increased State Emotional Exhaustion, the potential explanations for this outcome should be considered. To begin with, spending less Sedentary Time in response to increased State Emotional Exhaustion might have been a coping mechanism by the participants. For example, they might have decided to spend less time on Sedentary Activities, such as studying, when State Emotional Exhaustion spiked up, in order to distract themselves from negative feelings

To continue, Emotional Exhaustion is associated with distress, which can trigger physiological responses such as restlessness (Martínez et al., 2020; de Witte, 2020). Perhaps, this restlessness made it difficult for the participants to assume a Sedentary Posture. In addition to that, Patel (2005) found that students who are Emotionally Exhausted tend to excessively consume caffeinated beverages such as coffee or energy drinks. Increased caffeine intake reinforces feelings of nervousness, which might have urged the participants to increase their movement behaviour, leading to less Sedentary Time (Edward et al., 2020).

Sedentary Breaks as a moderator of Sedentary Behaviour on State Emotional Exhaustion

As a second goal, this study aimed to investigate whether Sedentary Breaks can be used to decrease State Emotional Exhaustion in higher education students. The current results support previous study outcomes, which demonstrated how Sedentary Breaks improved mental health (Hallgren et al., 2020). While the current moderation effect of Sedentary Breaks was small, this study adds to the literature by listing State Emotional Exhaustion as a further mental health problem that can be decreased by practicing more frequent Sedentary Breaks. Since State Emotional Exhaustion only slightly decreased with each additional Sedentary Break, the potential reasons should be considered. To begin with, the participants in this study had to rely on their memory to recall how many Sedentary Breaks they took since the last measurement. Therefore, their indications on Sedentary

Break frequency were probably not always accurate. To continue, this study did not assess the activities that participants engaged in while breaking their Sedentary Time. While previous research associated general Sedentary Breaks with decreased mental health problems (Hallgren et al., 2020), other studies stress the importance of the activities that individuals engage in while taking Sedentary Breaks. Giurgiu et al. (2019) who investigated how Sedentary Breaks contribute to the improvements of mood, found that Sedentary Breaks which include moderately intense activities, such as walking, had a more powerful effect than Sedentary Breaks in which participants simply stood up. This study did not take note of the activities that were initiated while the participants interrupted their Sedentary Time. Therefore, it remains unclear whether different Sedentary Break activities moderate State Emotional Exhaustion to differing extents. Assuming that moderately- active Sedentary Breaks are more beneficial, the only slight State Emotional Exhaustion improvements could be explained by participants not using Sedentary Breaks to their highest potential.

Limitations

Reflecting back, it is important to note that this study was met with significant methodological limitations. These might have influenced the emergence of unexpected outcomes. The first limitation becomes evident when comparing the assessments of Sedentary Time, to the assessments of Sedentary Breaks and Emotional Exhaustion. While Emotional Exhaustion and Sedentary Breaks were assessed four times per day, Sedentary Behaviour was assessed only once in the morning. This resulted in little knowledge about how the participants spread their Sedentary Time across the day. Moreover, the employment of a single Sedentary Time assessment, required the participants to accurately recall their Sedentary Time of the last 24 hours. It is likely that the participants memory was subjected to a retrospective recall bias. As a next problem, this study used a single item measurement of Sedentary Time. Compared to multiple item measurements, single item measurements can lead to inaccurate results, specifically tied to the underestimation of Sedentary Time due to a decreased criterion validity (Bakker et al., 2020). Consequently the item becomes less reliable. To continue, the comparatively few Sedentary Behaviour assessments were often left unanswered. Since the Sedentary Behaviour assessments took place in the morning, it can be assumed that some participants were still sleeping and therefore missed the single daily opportunity to indicate their Sedentary Time.

The next limitation concerns the assessment of Sedentary Breaks. To begin with, the current assessment tool, which is a self- report measure, is only weakly correlated with objective measures of Sedentary Breaks (Clark et al., 2011). In addition, there were time gaps of two to thirteen hours in between the assessments. Due to a retrospective recall bias, this, again, might have affected the accuracy with which participants estimated their Sedentary Breaks.

Continuing with next limitation, adapting and shortening the Emotional Exhaustion subscale from the Maslach- Burnout Inventory Student Survey might have disrupted the reliability and validity of how State Emotional Exhaustion was measured. According to Borah and colleagues (2018), trait measures, such as the MBI-SS are not sufficient in capturing momentary experiences. This makes using them in experience sampling studies rather unsuitable. Since there are no tools for measuring State Emotional Exhaustion, this study was reliant on adapting the MBI-SS to fit the study purpose. As explained by Sousa and colleagues (2016), even small adaptations can interfere with accuracy of the measurement instrument.

Strengths

While this study encountered significant limitations, there are some strengths to be pointed out. This study differentiated itself from numerous previous Sedentary Behaviour studies by using the Experience Sampling Method. A meta- study investigating previous research on Sedentary Behaviour, revealed that most studies used the cross- sectional study design (Wang, Li and Fan, 2019). As pointed out by Levin (2006), cross- sectional studies weaken the generalizability of results, since the outcome is specific to the single context that the measurement was taken in. Especially in the field of Psychology, behaviour is tied to the context in which it takes place (Myin- Germeys et al., 2018). By spreading regular, repeated measurements over a week, this study was able to accompany the participants through several mental contexts while collecting data.

The next strength concerns the topic that was chosen for research. The regulation of Sedentary Behaviour and Emotional Exhaustion plays a role in the maintenance of optimal mental health in higher education students (Jiménez- Ortiz et. al, 2019; Aguayo et. al, 2019; Shankland et. al, 2018). This is one of the first studies that investigate the association between Sedentary Behaviour and Emotional Exhaustion in higher education students. This study emphasized that the interplay between Sedentary Behaviour and mental health outcomes, or more specifically, State Emotional Exhaustion might be more complex than expected. While the current study results are not completely in line with previous research, they pose an opportunity to view the interaction between Sedentary Behaviour and mental health problems from a different perspective. Based on the long- term implications that Sedentary Behaviour and Emotional Exhaustion have for higher education students, future research is encouraged to further explore the link. This study can be seen as a starting point.

Practical Implications on Sedentary Time, Emotional Exhaustion and Sedentary Breaks

While increased Sedentary Time was associated with improvements in State Emotional Exhaustion and while increased State Emotional Exhaustion was associated with reductions in Sedentary Time, the current study results should be taken with caution. It might seem like

Sedentary Time increases are beneficial for the mental well-being and vice versa, however further research is needed to investigate the underlying mechanisms that might have led to this outcome. The results seem to imply that the association between Sedentary Behaviour and mental health is too complex to assume that all Sedentary Behaviours are problematic. Therefore, making general mental health guidelines, without segregating between different Sedentary Activities should perhaps be avoided. Aside from the unexpected associations, this study observed dangerously high volumes of Sedentary Behaviour while a fourth of the participants were on average suffering from high State Emotional Exhaustion on a daily basis. Higher education students can be more mindful about their Sedentary Behaviour and State Emotional Exhaustion levels, by for example integrating more frequent breaks into their Sedentary Time. Especially during phases of high distress, such as examination weeks, Emotional Exhaustion is likely to thrive. In those times especially, higher education students are advised to interrupt their Sedentary Behaviour more frequently as Sedentary Breaks can be utilized to regulate State Emotional Exhaustion.

Future Research

Based on the current study, some recommendations for future research can be made. To begin with, future research could explore the association between Sedentary Time and Emotional Exhaustion by clearly differentiating between mentally- active and mentally- passive Sedentary Activities. By using the Experience Sampling Method, participants could be asked to inform the researcher about the specific activities they engaged in, while being Sedentary. The answers could then be used to analyse whether mentally- active and mentally- passive Sedentary Activities lead to different Emotional Exhaustion outcomes.

Next, future research could explore whether different types of Sedentary Break Activities moderate the protective effect that Sedentary Breaks seems to have on State Emotional Exhaustion. Since previous research observed particular benefits when participants spent their Sedentary Breaks being moderately- active, the focus of future research could be on the Energy Expenditure of Sedentary Breaks.

Lastly, the current study results unexpectedly showed that State Emotional Exhaustion improved from increased Sedentary Time and that Sedentary Time was reduced on the days on which participants experienced elevated State Emotional Exhaustion. Since this is not in line with previous research, future research could explore potential confounding variables that might lead to such associations.

Conclusion

This study provides new insights on the link between Sedentary Behaviour and adverse mental health outcomes. While studies observed increasing mental health problems with increasing Sedentary Behaviour, Sedentary Time and State Emotional Exhaustion seem to be

slightly negatively associated with each other from both directions. Although this finding is not in line with expectations, the results provide an opportunity to consider additional factors that cause Sedentary Behaviour to decrease mental health problems. This study additionally shows that Sedentary Breaks are beneficial for decreasing State Emotional Exhaustion levels. This adds State Emotional Exhaustion to the list of adverse mental health conditions that can potentially be improved by becoming mindful of Sedentary Behaviour habits.

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Appendices

Appendix A: Information Sheet and Informed Consent


X

ÜBERSPRINGEN

Hello and thank you for signing up as a participant in our study!

We are three third year Psychology students from the University of Twente working on our Bachelor Thesis. For this study, we want to **explore the relationship between sedentary behaviour and states of psychological well-being**. Sedentary behaviour refers to any waking behaviour that requires little energy, such as sitting or laying down. Think of activities like watching a movie, reading, or working on a computer. Earlier research has shown that there is a correlation between sedentary behaviour and certain mental health risks. As we as students are sitting quite a lot, especially during the Covid-19 pandemic, we want to further explore this relationship between this behaviour and mental health.

Over the course of **the next eight days**, you will **fill in questionnaires** about your sedentary behaviour and three mental health dimensions that we are interested in - fatigue, emotional exhaustion, and motivation. In total, you will answer one questionnaire on the first day and four questionnaires on every remaining day. Filling in the questionnaires should **not take more than 20**

 ZURÜCK

 WEITER

X

ÜBERSPRINGEN

Over the course of **the next eight days**, you will **fill in questionnaires** about your sedentary behaviour and three mental health dimensions that we are interested in - fatigue, emotional exhaustion, and motivation. In total, you will answer one questionnaire on the first day and four questionnaires on every remaining day. Filling in the questionnaires should **not take more than 20 minutes in total per day**.

On the first study day, you will fill in one questionnaire in which we want to assess more general information. The following questionnaires will then focus on your sedentary behaviour and mental states during different times of the day. We will send you notifications to you when it is time to fill in the questionnaire. The **measurements will be at some point in the morning, in the noon, in the afternoon and in the evening**. The questionnaires will be **available to you for one hour** after you receive the notifications. If you should miss one of the questionnaires, don't worry about it! Just remember to fill in the other questionnaires still to come. **To summarize, completing the study will take eight days in total with one longer questionnaire on the first day, and four short questionnaires per day for the remaining 7 days. You will receive notifications and reminders when it is time to fill in the questionnaire.**

 ZURÜCK

 WEITER

X

ÜBERSPRINGEN

Keep in mind that at any point of the study, **you are free to opt out** of the study without having to provide an explanation. Your participation is completely **voluntary**.

Apart from the fact that participation will take a certain amount of time each day, there are **no inconveniences or risks** tied to this study.

The study will take place via Ethica, so make sure to have a smartphone, tablet, or computer with a working internet connection that is available to you during the day. If you don't want to install the app, Ethica also works in a browser of your choice. By working with Ethica, **all your information will be anonymized and it will not be possible to trace data back to you.**

By participating in this study you are contributing to important psychological research into the well being of students - thank you for that!

If you have any remaining questions, feel free to contact this email address:
j.wingbermuehle@student.utwente.nl.

 ZURÜCK

 WEITER

X

ÜBERSPRINGEN

Apart from the fact that participation will take a certain amount of time each day, there are **no inconveniences or risks** tied to this study.

The study will take place via Ethica, so make sure to have a smartphone, tablet, or computer with a working internet connection that is available to you during the day. If you don't want to install the app, Ethica also works in a browser of your choice. By working with Ethica, **all your information will be anonymized and it will not be possible to trace data back to you.**

By participating in this study you are contributing to important psychological research into the well being of students - thank you for that!

If you have any remaining questions, feel free to contact this email address:
j.wingbermuehle@student.utwente.nl.

Kind regards,

Judith, Simona and Jini

 ZURÜCK

 WEITER

X

ÜBERSPRINGEN

I have read and understood the study information. I have been able to ask questions about the study and my questions have been answered to my satisfaction.

 Yes No

X

ÜBERSPRINGEN

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.

 Yes No

✕ ÜBERSPRINGEN

I understand that taking part in the study involves a longer starting questionnaire, 4 short daily assessments of my behaviour and my mental state using the Ethica application (app or browser). I understand that I fill in these questionnaires without the researcher being present. Further, I was informed that all data will be anonymised and cannot be traced back to me.

Yes

No

↑ ZURÜCK WEITER ↓

✕ ÜBERSPRINGEN

I understand that information I provide will be used for a Bachelor thesis and that processed results may appear in published reports.

Yes

No

↑ ZURÜCK WEITER ↓



ÜBERSPRINGEN

I understand that data collected about me will not be shared beyond the study team.

 Yes No

ZURÜCK



WEITER



ÜBERSPRINGEN

I hereby declare that I have been fully informed about my participation in the described study. By ticking the box, I actively consent to participating in this study and the processing of by data.

 Yes No

ZURÜCK



WEITER

X

ÜBERSPRINGEN

Thank you for your answers :) If you are eligible to participate in this study, please proceed by answering the baseline questionnaire that is presented to you in the study overview.



ZURÜCK



EINREICHEN

Appendix B:

Morning assessment as an example of the repeated Daily Measurements

X

ÜBERSPRINGEN

Good morning, we hope you slept well!

The following questions assess your sedentary behaviour of the last 24 hours, since the last measure, and how you are currently feeling with regards to energy and motivation.

Sedentary behaviours are behaviours, that require very little energy such as sitting, laying down, or being in a reclining position. Think of activities like watching a movie, reading, or working on a computer.



ZURÜCK



WEITER



ÜBERSPRINGEN

How many hours did you approximately spend sitting or laying down in the last 24 hours?



0



ZURÜCK

WEITER



ÜBERSPRINGEN

Since the last measurement, how many times did you break up your sedentary behaviour?

This at least involves standing up and walking a couple of steps or stretching a bit



0



ZURÜCK

WEITER



ÜBERSPRINGEN

What did you **mainly** do while sitting or laying down since last measure (while being awake)?

only one answer possible

- Socializing
- Watching TV/Netflix/YouTube/etc.
- Reading
- Working on a laptop/computer
- Playing computer or video games
- Listening to music
- Playing a musical instrument
- Doing crafts or arts
- Travelling in a motorized vehicle (such as car, bus, train)

ZURÜCK

WEITER



ÜBERSPRINGEN

In the next section, we will ask some questions about your current mental state.

ZURÜCK

WEITER

X

ÜBERSPRINGEN

How fatigued do you currently feel?

1

10



Tippen Sie auf die Zeile, um zu beginnen

↑ ZURÜCK

↓ WEITER

X

ÜBERSPRINGEN

For the following items, please indicate on a scale from 0 to 6 how much you agree with the statements.

↑ ZURÜCK

↓ WEITER

X

ÜBERSPRINGEN

At the moment, I feel emotionally drained by my studies.

0

6

Tippen Sie auf die Zeile, um zu beginnen

↑ ZURÜCK

↓ WEITER

X

ÜBERSPRINGEN

At the moment, I feel burned out from my studies.

0

6

Tippen Sie auf die Zeile, um zu beginnen

↑ ZURÜCK

↓ WEITER

X

ÜBERSPRINGEN

At the moment, studying or attending a class is really a strain for me.

0

6

Tippen Sie auf die Zeile, um zu beginnen

↑ ZURÜCK

↓ WEITER

X

ÜBERSPRINGEN

Did you engage in any study related activities since the last measurement point?

 Yes No

↑ ZURÜCK

↓ WEITER

✕

ÜBERSPRINGEN

Thank you for your answers! See you soon :)

⬆ ZURÜCK

✓ EINREICHEN