Fitbit-Paper:

**Authors:** Runge, Haarmann & Fisher (2020)

**Journal:** International Journal of Social Policy and Education

**Title:** Using Fitbit Fitness Trackers to Measure Teacher Stress and Coping

* There is research that uses Fitbit technology to measure exercise and its effect on stress (Xu, et al., 2018) and the use of wearable devices to measure mental health outcomes (Knight & Bidargaddi, 2018), but there is a gap in literature to support teachers using Fitbits to pinpoint stressful occurrences in their daily work.
* Ferguson et al. (2015) found that Fitbit products were just as favorable and more affordable
* Research has shown that the variability in heart rates can predict stress levels since heart rates increase during stressful situations (Taelman, Vandeput, Spaepen, & Van Huffel, 2009)
* The average resting heartrate (HR) was measured in beats per minute (bpm) and ranges from 40 to 100 bpm in healthy adults. The average resting heart rate is calculated when at rest throughout the 24-hour period of one day.
* In terms of steps, average adults range from 5,000 to 7,000 steps per day with more active adults many times acquiring over 7,000.

**5.3 Fitbit Results**

* Line graphs were constructed to manage all data for each individual teacher.
* The numbers on the x-axis represent the weeks that Fitbit data was collected.
* The left y-axis represents the average amount of sleep for the week in hours, and the average amount of steps for the week (divided by 1000 to fit onto the table).
* The right y-axis represents the average resting heart rate for the week in beats per minute. The dotted lines represent the teacher’s overall average of sleep (dark grey), steps (black), or heart rate (light grey) throughout the study. We chose to define high levels of stress by weeks indicating above average heart rate, above average step count, and below average sleep.

Limitations:

* Small sample size (*N* = 4 teachers)

**\_\_\_\_\_\_\_\_\_\_\_\_**

**Authors:** Muggeridge et al (2020)

**Journal:** JMIR Mhealth Uhealth

**Title:** Measurement of Heart Rate Using the Polar OH1 and Fitbit Charge 3 Wearable Devices in Healthy Adults During Light, Moderate, Vigorous, and Sprint-Based Exercise: Validation Study

* Age and gender as a control variable
* Depending of the numbers of studies available different age groups will be analyzed independently (e.g., 18-45 years old, 45-65 years old, over 65 years old)
* Age range will be defined according to the mean age reported in each individual study
* placement of the Fitbit device [device up to three finger widths above the wrist bone; see (33)]
* the validation of multiple devices simultaneously (validation study including one device at a time
* the description of missing data (percentage of missing data for each analysis described)
* beat per minutes (bpm), and difference of steps per minutes (steps/min)?

**\_\_\_\_\_\_\_\_\_\_\_\_**

**Authors:** Jachymek et al. (2021)

**Journal:** JMIR Mhealth Uhealth

**Title:** Validation of heart rate measurement of Fitbit Charge 4 and Xiaomi Mi Band 5

**Background**: Recent advances in mobile sensor technology have led to increased popularity of wrist-worn fitness trackers. The possibility to use a smartwatch as a rehabilitation tool to monitor patients’ heart rate during exercise has won the attention of many researchers.

**Objective**: The aim of the study was to evaluate the accuracy and precision of HR measurement performed by two wrist monitors: Fitbit Charge 4 (Fitbit) and Xiaomi Mi Band 5 (Xiaomi).

**Methods**: 31 healthy volunteers were asked to perform a stress test on a treadmill. During the test their heart rate was recorded simultaneously by both wristbands and ECG at 1minute intervals. The mean absolute error percentage (MAPE), Lin’s concordance correlation coefficient (LCCC) and Bland-Altman were calculated to compare precision and accuracy of heart rate measurements. The estimated validation criteria were MAPE < 10% and LCCC < .8

**Results**: The overall MAPE of the Fitbit device was 10.19% (±11.79%) and the MAPE of Xiaomi was (6.89 % ± 9.75). LCCC of Fitbit HR measurements was .753 (95% CI:0.717-0.785) and of Xiaomi – .903 (0.886-0.917). In both devices the precision and accuracy were decreasing with the increasing exercise intensity. Age, sex, height, weight, BMI did not influence the accuracy of both devices.

**Conclusions**: The accuracy of a wearable wrist-worn heart rate monitor varies and depends on the intensity of training. The decision concerning the application of such a device as a monitor during in-home rehabilitation should be taken with caution, as it may prove not reliable enough.

**\_\_\_\_\_\_\_\_\_\_\_\_**

**Authors:** Kärner & Warwas (2018)

**Journal:** Unterrichtswissenschaft

**Title:** Stress im Unterricht? Prozessanalysen zu Interaktionseffekten unterrichtlicher Anforderungen und individueller Ressourcenbewertungen auf physische und psychische Stresssymptome von Berufsschüler/innen

**Own Study:**

**Abstract:**

**Background:**

Especially the first five years are a crucial time the teaching profession, whether the development from novice to expert is experienced as successful and as an increase in competence or leads to the fact that between 40 and 50 percent of the beginning teachers left the profession [@ingersoll2003wrong; @prilleltensky2016teacher]. One reason among many why teachers end their careers is the demanding workload and resulting stress in the teaching profession [@struyven2014teachers]. In her study with 400 secondary teachers, @fisher2011factors showed that burnout scores were significantly different between novice and experienced teachers, whereby novices had higher burnout. Furthermore, she found that low years of experience was a statistically significant predictor for stress in the teaching profession, along with job satisfaction and burnout.

The heart rate is considered an indicator of physical or emotional stress. Increased workload is accompanied by increased heart rate. Therefore, heart rate can be considered the most important psychophysiological parameter [@sachs2014physiologische].

low-cost, non-invasive, wrist-worn devices

There is a gap in research on whether heart rate measurements using fitness watches are appropriate to detect differences between experienced and inexperienced teachers in a laboratory setting.

**Objective:**

The aim of the study was to compare the heart rate and step counts

**Methods:**

40 expert teachers and 40 novice teachers were asked to teach a 15minute micro-teaching unit in a laboratory study whereas three actors represented the class. During the unit, the actors performed nine typical classroom disruptions. The subjects’ heart rate and steps were measured with a Fitbit Charge 4.

* Combining fitbit data with rating scale data (disruption and confidence factor)

**Results:**

We used a Fitbit Charge 4 to measure the teachers' heart rate. The device was attached 2-finger widths above the ulnar styloid process to the subject’s wrist following the manufacturer’s instructions. To determine the heart rate, the Fitbit flashes green LEDs many times per second and uses light-sensitive photodiodes to measure the volume changes in the capillaries and then calculates how many times the heart beats per minute (bpm). Data were automatically wireless synced with an iPad via Bluetooth to a Fitbit account, and subsequently, the intraday second-by-second data were exported for each session using the opensource software Pulse Watch (PulseWatch. URL: https://iccir919.github.io/pulseWatch/public/index.html [accessed 2022-08-03]).

**Conclusions:**