# Study Design with Overarching Challenge

## Research Objective

The aim of the study is to examine the impact of different training circuits – Exergame circuit, traditional endurance circuit, and a mixed circuit – on subjective motivation, enjoyment, team experience, perceived physical and cognitive exertion, as well as objective training intensity (heart rate) in healthy young adults. In addition, the effectiveness of an overarching team challenge as a motivational booster will be evaluated.

## 🧩 Participants & Group Allocation

* Approx. 60 participants, divided into 5 groups of 12 people
* Each group completes one of the three circuit types (between-subject design):

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| **Group** | **Circuit Type** |
| 1 & 2 | Exergame Circuit (3 stations) |
| 3 & 4 | Traditional Endurance Circuit (3 stations) |
| 5 (+ more) | Mixed Circuit (Exergame + 2 traditional machines) |

## 📝 Baseline Assessment (before training starts)

Standardized questionnaire covering:

* Gender
* Age
* Sports experience (frequency, type)
* Gaming experience (video games/exergames, yes/no, duration)

## 🎵 Framework & Challenge

* Background music plays throughout the circuit training for motivation and atmosphere
* Study leader guides the group, coordinates the process, and explains the challenge:
* All stations (whether exergame, traditional, or mixed) contribute to a shared points system
* Participants are aware they are competing together as a team
* The team with the most points at the end is declared the challenge winner
* The training leader ensures a smooth process, motivates, and supports

## 🏋️‍♂️ Station Overview

Exergame Circuit:

* ExerCube – Speedcage Mode
* Icarus Cloud – Biathlon Mode
* Boxing Exergame – Punching & Kicking

Traditional Endurance Circuit:

* Rowing machine
* Bike ergometer
* SkiErg

Mixed Circuit:

* ExerCube (Speedcage)
* Two traditional machines (e.g., Ergometer + Rowing machine)

## 🔄 Procedure per Group (approx. 90 minutes)

* 3 stations, 10 minutes each
* Approx. 2-minute transition between stations
* Duo training: both team members train simultaneously on the same device
* Trainer explains and oversees the challenge mechanics

## 🎯 Data Collection Methods

After each station:

* Motivation (Likert 1–5)
* Enjoyment (Likert 1–5)
* Team experience (only exergame duos, Likert 1–5)
* Subjective physical exertion (Borg RPE with smileys, 1–10)
* Subjective cognitive exertion (Likert 1–5)

Final overall evaluation:

* Overall experience (Likert 1–5)
* Overall motivation (Likert 1–5)
* Open feedback (free text)

## 🩺 Heart Rate Measurement (optional)

* Bluetooth chest strap (e.g., Polar H10) with smartphone app
* Continuous measurement, segmented by station
* Minimal effort required from the study leader

## 🔍 Analysis & Evaluation

* Compare motivation, enjoyment, team experience, subjective exertion (physical & cognitive) between circuit types (ANOVA/Kruskal-Wallis)
* Correlate subjective exertion – heart rate
* Qualitative analysis of open feedback

# Questionnaires

Baseline Assessment (demographics & experience)

Participant ID: \_\_\_\_\_\_\_\_\_\_\_

Gender: ☐ Male  ☐ Female  ☐ Diverse  ☐ Prefer not to say

Age: \_\_\_\_ years

Sports experience: ☐ 1 (none)  ☐ 2  ☐ 3  ☐ 4  ☐ 5 (very frequent)

Gaming experience (video games/exergames): ☐ Yes  ☐ No; If yes, duration: \_\_\_\_ months/years

1. How motivated did you feel just now? ☐ 1 Not at all  ☐ 2 Little  ☐ 3 Moderate  ☐ 4 Good  ☐ 5 Very

2. How much fun did you have? ☐ 1 Not at all  ☐ 2 Little  ☐ 3 Moderate  ☐ 4 Good  ☐ 5 Very

3. How intense was the physical exertion? (Borg RPE scale 1–10, 1 = very light 😊 to 10 = maximal 😵‍💫)

4. How intense was the cognitive exertion? (Likert 1–5 or Borg-style scale)

5. How did you experience teamwork? ☐ 1 Very poor  ☐ 2 Poor  ☐ 3 Moderate  ☐ 4 Good  ☐ 5 Very good

Final Evaluation (after last circuit):

1. How would you rate the overall experience?

2. How motivated do you feel now?

3. What did you particularly enjoy? ...

4. What could be improved? ...

# Study Leader Guide

Preparation:

* Prepare materials (questionnaires, devices, heart rate sensors)
* Prepare music playlist (motivating, neutral background music)
* Be ready to explain the challenge

Procedure:

1. Welcome & Introduction (approx. 5 min) – explain process, safety rules, team challenge
2. Fill out baseline questionnaire (approx. 5 min)
3. Circuit training (3 stations, 10 min each + 2 min transitions)
4. Final questionnaire (approx. 10 min)
5. Farewell & thank you (approx. 5 min)

Heart Rate Measurement:

* Attach sensor before training begins
* Start measurement via app and run continuously during training
* Segment and save data after each training session

# Hypotheses

**H1 (Motivation & Fun):** The Exergame circuit leads to higher subjective motivation and more fun than the traditional endurance circuit. The mixed circuit lies in between.

**H2 (Team Experience):** Participants in the Exergame circuit report a stronger sense of teamwork than those in the traditional circuit, as duo coordination is more intensively promoted.

**H3 (Subjective Exertion):** Perceived cognitive exertion is higher in the Exergame circuit than in the traditional circuit, while physical exertion is comparable or higher in the traditional circuit.

**H4 (Objective Training Intensity):** Heart rate during training does not differ significantly between circuit types.

**H5 (Challenge Effect):** The overarching team challenge enhances motivation and overall experience regardless of the circuit type.

# Evaluation Methods and Statistical Tests

1. Descriptive Statistics:

* Calculate means (M), standard deviations (SD), and distributions for all scales (motivation, fun, team experience, subjective exertion, heart rate)
* Display demographic data (age, gender, sports and gaming experience)

2. Group Comparisons (Circuit Types):

* Test for normality: Shapiro-Wilk test for each variable and group
* If normal: One-way ANOVA for independent samples
* If not normal: Kruskal-Wallis test as non-parametric alternative

**Goal:** Test for significant differences between **Exergame**, **Classic**, and **Mixed Circuits** for:  
motivation, fun, team experience, perceived exertion (physical & cognitive), and heart rate

* Post-hoc tests: Tukey HSD (ANOVA) or Dunn Test with Bonferroni correction (Kruskal-Wallis)

3. Correlations:

* Pearson or Spearman correlation (depending on distribution) between subjective exertion (physical/cognitive) and heart rate

4. Challenge Effect Analysis:

* **Within each group:** Analyze links between perceived motivation/experience and challenge score
* **Between groups:** Explore variance in motivation/experience by challenge participation

5. Qualitative Analysis:

* Content analysis of open feedback using a deductive-inductive approach to identify recurring themes

# Summary

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| **Variable** | **Test Method** | **Goal** |
| Motivation, Fun, Team Experience, Subjective Exertion | Shapiro-Wilk + ANOVA/Kruskal-Wallis + Post-hoc | Group comparison across circuit types |
| Heart Rate | Shapiro-Wilk + ANOVA/Kruskal-Wallis | Objective intensity differences |
| Correlation (Exertion vs. HR) | Pearson/Spearman | Relationship between subjective & objective effort |
| Challenge Effect | Correlation + exploratory variance analysis | Influence of challenge on motivation & experience |
| Open Feedback | Qualitative content analysis | Deeper insights into subjective experiences |