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Does a virtual reality dance game improve self-control and brain activity in young adults more than the same workout following a video?

Submission date 01/10/2026	**Recruitment status** No longer recruiting	[X] Prospectively registered [X] Protocol [_] Statistical analysis plan [_] Results [_] Individual participant data [X] Record updated in last year
Registration date 02/10/2026	**Overall study status** Ongoing	
Last Edited 13/11/2026	**Condition category** Other	

Plain English summary of protocol

Background and study aims
Physical exercise that also challenges the mind, such as dance video games, can improve the ability to control impulses and focus attention. Virtual reality headsets make these games more immersive, which might increase these benefits, but this has not been well tested. This study aims to find out whether playing a dance game in virtual reality improves self-control and brain activity more than doing exactly the same workout by following a video on a normal screen, both after a single session and after 10 weeks of training.

Who can participate?
Healthy adults aged 18 to 30 years who are students in vocational training or university programmes, who can safely do moderate exercise and who do not regularly play virtual reality rhythm games.

What does the study involve?
There are two separate studies with different participants. In the first study, each participant does two exercise sessions at least 3 days apart: one playing the game Beat Saber with a virtual reality headset, and one copying the same movements from a video on a large screen while holding foam sticks. The order of the sessions is decided at random. In the second study, participants are randomly placed in one of these two groups and train three times a week for 10 weeks. Each session lasts about 23 minutes and uses the same songs and movements in both groups. Before and after the sessions, participants complete a short attention test (the Stroop test) while their brain activity is recorded with a wireless headset (EEG), and answer questionnaires about their mood, confidence, enjoyment and any dizziness. Heart rate and arm movement are recorded during exercise. In the 10-week study, these tests are done at the start, after 5 and 10 weeks, and 4 weeks after training ends.

What are the possible benefits and risks of participating?
Participants may not benefit directly, but they will take part in a supervised exercise programme. The risks are considered minimal and include mild muscle tiredness, slight discomfort from the sensors, and possible dizziness or motion sickness from the virtual reality headset. All sessions

are supervised by trained researchers, and symptoms of dizziness are checked before and after each virtual reality session.

Where is the study run from?
University of Seville and Universidad Loyola Andalucía (Spain)

When is the study starting and how long is it expected to run for?
October 2026 to December 2027

Who is funding the study?
1. Spanish Ministry of Science, Innovation and Universities, State Research Agency (MICIU/AEI)
2. European Social Fund Plus (ESF+)

Who is the main contact?
Dr Sonia Ortega-Gómez, sortega@us.es

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Scientific, Public, Principal investigator

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Study information

Scientific Title
Immersive virtual reality exergaming versus video-guided screen-based exercise for cognitive and neurophysiological adaptations in young adults: an acute randomized crossover study and a 10-week randomized controlled trial.

Study objectives
To examine the acute and chronic effects of an immersive virtual reality (VR) dance exergame, considered as an integrated package of immersion, interactivity and real-time performance feedback, compared with a matched video-guided screen-based exercise condition (CS), on inhibitory control (primary outcome), and on frontal cortical activity, perceived self-efficacy, affective state and physiological response (mechanistic and secondary outcomes), in healthy young adults.

Hypotheses: compared with CS, the VR condition will produce greater improvement in inhibitory control (Stroop interference index) and greater frontal theta power, together with higher perceived self-efficacy, enjoyment and positive affect, while maintaining comparable physiological and motor load. In the chronic study, the between-condition difference is expected to accumulate across sessions, being larger at week 10 than at week 5.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 05/06/2026, Research Ethics Committee of Universidad Loyola Andalucía (Avenida de las Universidades 2, Dos Hermanas, 41704, Spain; +34 696761971; comiteetica@uloyola.es), ref: 260318 CE26666

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Open (masking not used)

Control
Active

Assignment

Two independent studies with non-overlapping samples: (1) an acute randomized two-period, two-sequence crossover study (VR then CS, or CS then VR; washout ≥72 h); (2) a 10-week two-arm parallel-group randomized controlled trial (VR vs CS, 1:1).

Purpose
Basic science

Study type(s)

Health condition(s) or problem(s) studied
Executive function (inhibitory control) and frontal cortical activity in healthy young adults

Interventions
Two independent studies with non-overlapping samples are conducted at the same research facility.

Exercise task (both conditions): a standardized playlist of nine songs from Beat Saber Original Soundtrack Vol. 1, played at Easy difficulty with "No Fail" mode, with identical song order, tempo (80–210 bpm), movement sequence and transition periods (~25 s between songs). Active exercise time is 19 min 48 s; total session duration is approximately 23 min.

Experimental condition (VR): participants play Beat Saber in immersive virtual reality using a Meta Quest 2 headset and wireless controllers, receiving real-time task feedback and score progression inherent to the game.

Comparator condition (CS, video-guided screen-based exercise): participants watch a pre-recorded video of a researcher performing the same playlist on a 55-inch screen placed 1.5 m in front of them and reproduce the movements holding foam sticks that simulate the controllers. Music, song order, tempo, movements, difficulty, transitions and duration are matched to the VR condition, with sound at approximately 70 dB in both conditions.

Acute study (up to 40 participants): randomized two-period crossover. Participants are allocated 1:1, stratified by sex, to the sequence VR then CS or CS then VR, with a washout of at least 72 h between sessions. Assessments are performed before and after each session.

Chronic study (64 participants): two-arm parallel randomized controlled trial. Participants are allocated 1:1 to VR or CS using sex-stratified block randomization (blocks of 4) and complete 3 sessions per week for 10 weeks (30 sessions). Assessments at baseline (week 0), midpoint (week 5), post-intervention (week 10) and 4-week follow-up (week 14).

Randomization: computer-generated sequences (Research Randomizer) prepared by a researcher not involved in recruitment, intervention delivery or outcome assessment, concealed in sequentially numbered, sealed, opaque envelopes opened after consent and eligibility confirmation.

Intervention Type
Behavioural

Primary outcome(s)
1. Inhibitory control (Stroop interference index) measured using the Stroop Color and Word Test (sheet-based format); interference index computed as CW – CW (higher = better interference

control) at baseline (before) and after each experimental session (VR and CS) in the acute crossover study, and baseline (week 0), midpoint (week 5), post-intervention (week 10) and 4-week follow-up (week 14) in the chronic RCT

Key secondary outcome(s)

1. Frontal theta power (confirmatory mechanistic endpoint) measured using absolute theta power (4–7 Hz) averaged across F3, F4, AF3 and AF4 during the Stroop colour-word interference condition, recorded with an Emotiv EPOC X EEG system (256 Hz), at baseline (before) and after each experimental session (VR and CS) in the acute crossover study, and weeks 0, 5, 10 and 14 in the chronic RCT

2. Frontal alpha and beta power measured using absolute alpha and beta power at frontal electrodes during resting state and the Stroop task, recorded with an Emotiv EPOC X EEG system (256 Hz) at baseline (before) and after each experimental session (VR and CS) in the acute crossover study, and weeks 0, 5, 10 and 14 in the chronic RCT

3. Perceived self-efficacy measured using a six-item scale constructed following Bandura's guidelines and adapted to active video games; items rated 0–100, global mean score at baseline (before) and after each experimental session (VR and CS) in the acute crossover study, and weeks 0, 5, 10 and 14 in the chronic RCT

4. Positive and negative affect measured using the Positive and Negative Affect Schedule (PANAS, Spanish version); positive and negative affect subscales, 10–50 each, at baseline (before) and after each experimental session (VR and CS) in the acute crossover study, and weeks 0, 5, 10 and 14 in the chronic RCT

5. Heart rate and exercise intensity measured using mean heart rate, maximum heart rate and percentage of heart rate reserve (Karvonen formula), recorded with a Polar H10 chest strap monitor, at 3-minute seated baseline before exercise and continuously during every exercise session (both studies)

6. Rating of perceived exertion measured using the Borg CR-10 scale (0–10) at within 1 minute after each exercise session (both studies)

7. Movement intensity measured using Wrist-worn ActiGraph wGT3X-BT accelerometer (100 Hz, dominant wrist): counts per minute, vector magnitude and estimated steps, at continuous recording during every exercise session (both studies)

8. Presence measured using the Igroup Presence Questionnaire (IPQ), 14 items rated on a 7-point scale subscale means, at after each condition in the acute study and after the first and final intervention sessions in the chronic RCT:

9. Cybersickness measured using the Simulator Sickness Questionnaire (SSQ), 16 items; total severity score, at immediately before and after each virtual reality exposure (VR condition only, both studies)

10. Enjoyment measured using Physical Activity Enjoyment Scale (PACES, Spanish version), 16 items; total score 16–80 at after each condition in acute study and after the first and final intervention sessions in the chronic RCT

11. Participant expectations measured using a study-specific item rated 0–10, applied separately to each condition, at before the first experimental session only (both studies)

Completion date
31/12/2027

Eligibility

Key inclusion criteria
1. Aged 18 to 30 years
2. Students enrolled in Higher Vocational Training programmes or university degree courses
3. Absence of neurological, cardiovascular or musculoskeletal conditions incompatible with moderate-intensity physical exercise
4. Sufficient functional capacity to perform the exercise task
5. Availability to complete the procedures of the assigned study (acute crossover study or 10-week randomized controlled trial)
6. Written informed consent

Healthy volunteers allowed
Yes

Age group
Adult

Lower age limit
18 Years

Upper age limit
30 Years

Sex
All

Total final enrolment
0

Key exclusion criteria
1. Diagnosis of a neurological disorder, including photosensitive epilepsy
2. Vestibular disorders or history of severe dizziness
3. Current use of psychotropic medication
4. Uncorrected visual impairment or colour-vision deficiency (e.g., colour blindness)
5. Regular engagement with Beat Saber or similar rhythm-based virtual reality exergames (at least one session per week during the previous six months)

Date of first enrolment
02/10/2026

Date of final enrolment
15/10/2026

Locations

Countries of recruitment
Spain

Sponsor information

Organisation
Universidad Loyola Andalucía

ROR
https://ror.org/0075gfd51

Organisation
Universidad de Sevilla

ROR
https://ror.org/03yxnpp24

Funder(s)

Funder type

Funder Name
Agencia Estatal de Investigación

Alternative Name(s)
Spanish State Research Agency, Spanish Agencia Estatal de Investigación, AEI

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
Spain

Funder Name
European Social Fund Plus

Alternative Name(s)

European Social Fund, Европейският социален фонд, Европейският социален фонд плюс, Fondo Social Europeo, Fondo Social Europeo Plus, Ευρωπαϊκό Κοινωνικό Ταμείο, Ευρωπαϊκό Κοινωνικό Ταμείο+, Ciste Sóisialta na hEorpa Plus, Ciste Sóisialta na hEorpa, ESF, ESF+, ΕΚΦ, ΕΚΦ+, FSE, FSE+, EKT, EKT+, CSE, CSE+

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated and analysed during the studies will be available from the corresponding author (Dr Sonia Ortega-Gómez, sortega@us.es) on reasonable request after publication of the main results. Data will be shared in anonymised form, in accordance with Regulation (EU) 2016/679 and Spanish Organic Law 3/2018, and subject to a data sharing agreement.

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Protocol article		12/11/2026	13/11/2026	Yes	No
Participant information sheet			02/10/2026	No	Yes
Participant information sheet			02/10/2026	No	Yes