

STUDY PROTOCOL

Immersive versus screen-based virtual classroom training for academic interaction among autistic university students in Jordan: protocol for a pilot randomised controlled trial

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Protocol version: 1.0, [date]. **Trial registration:** to be registered at ClinicalTrials.gov before the first participant is enrolled; registration number [pending].

Word count: main text approximately 3,600 words (including tables); abstract 345 words. **Reporting guideline:** SPIRIT 2025, with TIDieR for intervention description; the future results report will follow the CONSORT extension for randomised pilot and feasibility trials.

Abstract

Background: Autistic students increasingly enter higher education but complete it at lower rates than their peers, and taking part in class, by answering, asking, discussing and presenting, is a recurring, often assessed demand. Virtual reality (VR) allows repeatable, adjustable rehearsal of such situations, yet controlled trials of immersive VR in autism show small pooled effects, rarely include follow-up, and seldom test whether gains transfer to real settings. No trial has isolated the added value of immersion over identical screen-based practice for autistic university students, and we identified none conducted in an Arabic-speaking setting.

Objective: To assess the feasibility, acceptability and safety of a two-arm randomised trial comparing immersive VR with screen-based delivery of the same virtual classroom training, and to estimate the between-arm difference in real-world academic interaction to inform a definitive trial.

Methods: A 16-week, single-site, parallel-group, assessor-blinded pilot randomised controlled trial with 1:1 allocation. Twenty-four enrolled autistic university students aged 18 years or over in Jordan will be randomised to immersive VR (head-mounted display) or screen-based delivery of an identical bilingual (Jordanian Arabic and English) virtual classroom programme comprising 12 facilitated sessions over 6 weeks. Weeks 1 to 8 are allocated to software development, with ethics approval and recruitment in parallel. Primary objectives concern feasibility: recruitment, retention (target $\geq 80\%$), session attendance (≥ 9 of 12 sessions in $\geq 75\%$ of participants), safety and rater reliability (intraclass correlation ≥ 0.75). The candidate primary efficacy outcome is the number of verbal contributions in a standardised 15-minute live seminar task at week 15, video-rated by two raters blind to allocation; presentation quality (Public Speaking Competence Rubric), public-speaking anxiety, cybersickness, usability, maintenance at week 16 and self-logged real-class contributions are secondary outcomes. Between-arm differences will be estimated with ANCOVA adjusted for baseline, with 95% confidence intervals, on an intention-to-treat basis.

Discussion: The trial will establish whether a definitive multi-site trial is feasible and provide the variance and effect-size estimates needed to power it. By holding content and facilitator time constant, it isolates the contribution of immersion, a question that determines whether universities should invest in headsets or in screen-based tools.

Keywords: autism; virtual reality; higher education; class participation; public speaking; pilot randomised controlled trial; Jordan; protocol

Administrative information

Item	Information
Title	Immersive versus screen-based virtual classroom training for academic interaction among autistic university students in Jordan: protocol for a pilot randomised controlled trial
Trial registration	ClinicalTrials.gov; to be registered before enrolment (number pending). The WHO Trial Registration Data Set is provided in Supplementary Table S1.
Protocol version	Version 1.0, [date]
Funding	[Source of funding or "No external funding"]; in-kind support (room and equipment) from [University]
Sponsor	[University name], [address]; contact: [name, email]
Role of sponsor and funders	The sponsor and funders have no role in study design, data collection, analysis, interpretation, writing or the decision to publish, and no authority over these activities.
Contributors and roles	[Author 1]: conception, design, protocol writing, principal investigator. [Author 2]: methodology, statistical analysis plan. [Author 3]: software development lead. All authors approved the final protocol.
Trial management	A trial management group (principal investigator, trial coordinator, software developer) meets weekly. An independent faculty member not involved in delivery reviews adverse events and protocol adherence monthly (see Monitoring).

Open science

Trial registration

The trial will be prospectively registered at ClinicalTrials.gov before the first participant is enrolled. Any registration number will be added to this protocol and cited in all reports.

Protocol and statistical analysis plan

This protocol and a detailed statistical analysis plan, finalised before database lock and before unblinding of group labels to the analyst, will be deposited on the Open Science Framework (OSF) with a time-stamped, persistent identifier.

Data sharing

De-identified individual participant data with a data dictionary, the statistical code, the outcome rating manual and the session plans will be made available on the OSF after publication of the main results. Video recordings will not be shared, because they cannot be de-identified; they will be deleted after rating and verification, as described under Confidentiality. The virtual classroom software will be made available to other universities on request for non-commercial use.

Funding and conflicts of interest

[Funding statement]. The authors declare no financial or other conflicts of interest. No author has a commercial interest in the software or any VR hardware manufacturer.

Dissemination policy

Results will be posted to the trial registry within 12 months of study completion and submitted for publication in a peer-reviewed, open-access journal regardless of direction or statistical significance. Participants will receive a plain-language summary in Arabic and English, and findings will be presented to the university's student services and academic leadership. Authorship will follow ICMJE criteria; no professional writers will be used.

Introduction

Background and rationale

Autistic students are entering higher education in growing numbers, but participation does not mean equal outcomes. A recent systematic review of support programmes reported retention or graduation of 35% for autistic students compared with 67% for their non-autistic peers [1]. In a UK survey, 77.8% of autistic students (49 of 63) had considered dropping out, compared with 61.6% of non-autistic students (165 of 268) [2]. In Arab countries the evidence base is particularly thin: a scoping review identified only 12 assistive-technology studies on autism across the region, mostly with school-aged boys, and only one from Jordan, which included children aged 5 to 13 [3]. None addressed adults or university students.

Academic interaction, meaning answering when called on, asking the lecturer a question, contributing to group discussion and presenting, is expected in most university courses and is frequently assessed. These are social situations that are difficult to rehearse repeatedly in real life, which makes them a natural target for simulation.

Simulation training can change real outcomes. In a randomised trial of 71 autistic transition-age youth, 25.0% of those who completed 15 sessions of computer-delivered virtual interview training obtained competitive integrated employment within six months, compared with 0.0% of those receiving services as usual ($\chi^2 = 6.9$, $p < 0.01$) [4]. However, that training was delivered on a standard computer rather than a head-mounted display, and the authors reported that the trial was not fully powered.

For immersive VR specifically, the evidence is promising but limited. A meta-analysis of controlled trials of immersive VR interventions for autism found a small-to-moderate pooled effect (Cohen's $d = 0.285$, 95% CI 0.132 to 0.438); every controlled trial targeted social or affective skills, only 3 of 15 studies reported follow-up, and none examined in depth whether gains transferred to real-life situations [5]. A broader meta-analysis of VR and augmented reality interventions reported a pooled effect of $g = 0.74$ across 26 uncontrolled studies but $g = 0.45$ across 9 controlled trials, with a confidence interval including zero [6]. The transfer gap is illustrated by a controlled trial of 94 autistic children in which measures close to the trained task improved (for example, affective expression, $d = 0.89$) while daily-life adaptive behaviour measures remained near zero (d between -0.12 and 0.12) [5,7].

Speaking in front of others is the most demanding element of academic interaction, and VR has an established role here: a meta-analysis of 11 studies (508 participants) found that VR exposure reduced public-speaking anxiety with a large effect compared with control (-1.39), only marginally below in-vivo exposure [8]. For autistic adults, the only randomised trial identified was small (23 participants aged 18 to 25) and reported higher self-confidence and lower salivary cortisol with a virtual-audience programme than with independent training [9].

Two questions therefore remain open. First, it is unknown whether immersion itself adds value over the same content delivered on an ordinary screen, a question with direct cost implications for universities. Second, it is unknown whether such training changes behaviour in real academic settings. Before a definitive trial can address these questions, the feasibility of recruitment, retention, delivery and blinded real-world outcome assessment in this population and setting must be established.

Choice of comparator

The comparator is screen-based delivery of identical scenarios, software, session structure, facilitator time and real-world tasks. Only the display modality differs. This active, dose-matched comparator isolates the

contribution of immersion and controls for attention, practice and facilitator contact, which a usual-care or waitlist comparator would not. A usual-support arm is deferred to a future definitive trial.

Objectives

Primary (feasibility) objectives: to estimate (1) the recruitment rate; (2) retention to week 15; (3) adherence, defined as sessions attended; (4) the frequency and nature of harms, including cybersickness and distress; and (5) the inter-rater reliability of the blinded seminar task rating.

Secondary objectives: to estimate, with 95% confidence intervals, the between-arm difference in real-world academic interaction at week 15 and its maintenance at week 16; to estimate between-arm differences in presentation quality, public-speaking anxiety and usability; and to obtain the standard deviation and baseline–outcome correlation of the candidate primary outcome needed to calculate the sample size of a definitive trial. In line with guidance for pilot trials, efficacy estimates are exploratory and will not be interpreted as tests of effectiveness [10].

Methods

Patient and public involvement

Autistic students will contribute to the design of the software. In weeks 6 and 7, a small group of autistic students who are not enrolled in the trial will test the prototype for comfort, clarity and usability, and will review the participant information sheet and consent form for readability. Their feedback will be used to adjust scenarios, sensory settings and participant materials before baseline. They will be compensated for their time. Participants will receive a plain-language summary of results.

Trial design

This is a single-site, two-arm, parallel-group, assessor-blinded pilot randomised controlled trial with 1:1 allocation and an exploratory framework. The total duration is 16 weeks: weeks 1 to 8 for software development, ethics approval, registration and recruitment; week 8 for baseline assessment and randomisation; weeks 9 to 14 for intervention delivery; week 15 for post-intervention assessment; and week 16 for follow-up assessment and analysis.

Trial setting

The trial will take place in a quiet, dedicated room at [University], Amman, Jordan, with a seated and a standing area. Real-world seminar tasks will take place in an ordinary university seminar room on the same campus.

Eligibility criteria

Participants. Inclusion: currently enrolled university students; aged 18 years or over; an autism diagnosis documented by a qualified clinician; enrolled in at least one course that involves in-class participation during the study period; able to communicate in Arabic or English; and able to provide informed consent. Exclusion: photosensitive epilepsy or a history of seizures triggered by visual stimuli; a vestibular or visual condition that, in the opinion of the screening clinician, makes headset use unsafe even in seated mode; or current participation in another structured social-communication programme.

Facilitators and raters. Facilitators will be members of the study team with a background in psychology, special education or a related field, who complete 8 hours of training in the session manual and safety procedures.

Raters will be members of the team who do not facilitate sessions for the participants they rate and who complete PSCR and participation-count training (see Data collection).

Intervention and comparator

Both arms receive the same virtual classroom programme, described using the TIDieR checklist in Table 1 [11]. The programme targets four academic interaction skills: answering when called on, asking the lecturer a question, joining a group discussion and giving a short presentation. Scenarios are set in a virtual university classroom whose class size (3 to 30 students), attention level, frequency of questions directed at the student and background noise can be adjusted. Practice proceeds through five levels: study room (answer a known question to three friendly classmates), seminar room (ask the lecturer a question), discussion table (share a view and disagree politely), lecture hall (a short presentation with questions) and the real class. Each session follows the same five steps: preview of the goal, settings and stop procedure; modelling of more than one acceptable strategy; rehearsal at adaptive difficulty; replay and reflection with the facilitator; and agreement of one small real-world task for the week. Motivational features are designed for adults: a free choice of added challenges, strategy cards unlocked with progress, comparison only with the participant's previous attempt and initial topics chosen by the participant. Eye contact and tone of voice are never scored, and more than one response is accepted as correct.

Immersive VR arm. Participants use a head-mounted display in seated mode by default, in blocks of no more than 15 minutes separated by breaks. **Screen-based arm.** Participants run the identical software on a standard computer monitor with mouse and keyboard, with the same session structure, timing, facilitator and real-world tasks.

Table 1. Intervention description (TIDieR)

TIDieR item	Immersive VR arm	Screen-based arm
1. Name	Virtual classroom training, immersive delivery	Virtual classroom training, screen delivery
2. Why	Repeated, adjustable rehearsal of academic interaction in a realistic setting; immersion may increase presence and transfer	Same rationale without immersion, isolating its contribution
3. What (materials)	Virtual classroom software (Jordanian Arabic and English); session manual; strategy cards; weekly task sheet	Identical software and materials
4. What (procedures)	Five-step session: preview, model, rehearse, reflect, real-world task	Identical
5. Who provides	Trained facilitator from the study team	Same pool of facilitators
6. How	Individual, face to face, head-mounted display	Individual, face to face, computer monitor
7. Where	Dedicated room at [University]	Same room
8. When and how much	12 sessions, twice weekly for 6 weeks, about 40 minutes each; headset blocks of ≤15 minutes	12 sessions, twice weekly for 6 weeks, about 40 minutes each
9. Tailoring	Sensory settings, language, difficulty and topics adjusted to the participant	Identical
10–12. Modifications and fidelity	Recorded in session logs; fidelity checklist completed for every session and 20% independently checked	Identical

Criteria for discontinuing or modifying the intervention. A session will be paused or stopped at the participant's request at any time, without penalty, or if the facilitator observes signs of distress, overload or

cybersickness. In the VR arm, persistent discomfort will first be addressed by reducing motion, brightness and block length. If a participant in the VR arm cannot tolerate the headset, they may complete remaining sessions on screen; they will remain in their allocated group for analysis and the switch will be reported. Participants may withdraw from the intervention while continuing to provide outcome data.

Adherence. Sessions will be scheduled around participants' timetables, with reminders the day before. Attendance, minutes of practice and completed real-world tasks will be logged automatically and by the facilitator.

Concomitant care. Participants may continue to use all usual university support services. Participation in another structured social-communication or public-speaking programme during the trial is not permitted; concomitant support will be recorded at baseline and week 15.

Outcomes

Outcomes, measurement variables, analysis metrics, methods of aggregation and time points are summarised in Table 2.

Table 2. Outcomes

Outcome	Measurement variable	Metric and aggregation	Time point
Feasibility (primary objectives)			
Recruitment	Eligible students who consent / students screened	Proportion with 95% CI; participants per week	Weeks 3–8
Retention	Participants completing the week-15 assessment	Proportion with 95% CI, by arm	Week 15
Adherence	Sessions attended (of 12)	Mean (SD); proportion attending ≥ 9	Weeks 9–14
Harms	Adverse events; serious adverse events; sessions stopped for discomfort	Counts and proportions, by arm	Every session
Rater reliability	Agreement between two raters on the seminar task	ICC (two-way random, absolute agreement) with 95% CI	Weeks 8, 15
Candidate primary efficacy outcome			
Academic interaction	Number of verbal contributions (answers, questions, discussion turns and clarification requests) in the standardised 15-minute seminar task	Final value adjusted for baseline; mean (SD), adjusted mean difference with 95% CI	Week 15 (baseline week 8)
Secondary outcomes			
Presentation quality	Public Speaking Competence Rubric total [12], nonverbal item adapted so that eye contact is not scored	As above	Weeks 8, 15
Public-speaking anxiety	Personal Report of Public Speaking Anxiety total [13]	As above	Weeks 8, 15, 16
Maintenance	Verbal contributions in a parallel-form seminar task	As above	Week 16
Real-class contributions	Self-logged questions, answers or presentations in lectures	Count per week; median (IQR)	Weeks 15–16

Outcome	Measurement variable	Metric and aggregation	Time point
Cybersickness	Simulator Sickness Questionnaire total [14]	Mean (SD) per session, by arm	Every session
Usability	System Usability Scale [15]	Mean (SD), by arm	Week 15

Harms

Harms will be assessed systematically. Before and after every session, participants complete the Simulator Sickness Questionnaire, and facilitators record any adverse event using a structured log covering nausea, dizziness, headache, eye strain, sensory overload, distress, shutdown or meltdown, and falls. An adverse event is any unfavourable experience during or within 24 hours of a session. A serious adverse event is any event that requires medical care or hospital admission. All events, their severity, relatedness and resolution will be reported by arm, including in participants who discontinue.

Participant timeline

The schedule of enrolment, interventions and assessments is shown in Table 3.

Table 3. Schedule of enrolment, interventions and assessments

	Enrolment (wk 3–7)	Allocation (wk 8)	Sessions (wk 9–14)	Post (wk 15)	Follow-up (wk 16)
Eligibility screen	•				
Informed consent	•				
Demographics, concomitant support	•			•	
Allocation		•			
Immersive VR arm			•		
Screen-based arm			•		
Seminar task (verbal contributions, PSCR)		•		•	•†
PRPSA		•		•	•
SSQ, adverse event log			•		
System Usability Scale				•	
Real-class contribution log				•	•

† Verbal contributions only (parallel-form task). PRPSA, Personal Report of Public Speaking Anxiety; PSCR, Public Speaking Competence Rubric; SSQ, Simulator Sickness Questionnaire.

Sample size

Consistent with the objectives of a pilot trial, the sample size is not based on a power calculation for efficacy. Twelve participants per arm (24 in total) follows the widely used rule of thumb for estimating the variance of a continuous outcome in pilot studies [16]. With 24 participants, a retention rate of 80% would be estimated with a 95% confidence interval of approximately ± 16 percentage points. The observed standard deviation and baseline–outcome correlation will be used to calculate the sample size of the definitive trial.

Recruitment

Participants will be recruited through the university's student services and disability support office, which will send study information to registered autistic students, and through posters and announcements in student spaces. Recruitment will begin in week 3, in parallel with software development, and will extend to nearby universities if fewer than 24 participants are enrolled by week 7. A screening log will record the number of students approached, screened, eligible and consenting, and reasons for non-participation.

Assignment of interventions

Sequence generation. A member of the team who is not involved in recruitment, delivery or rating will generate the allocation sequence by computer, using permuted blocks of varying size, with 1:1 allocation and no stratification. Block sizes will be held in a separate document unavailable to those who enrol participants.

Allocation concealment. Allocations will be placed in sequentially numbered, opaque, sealed envelopes prepared by the same team member. **Implementation.** The trial coordinator will enrol participants and open the next envelope only after the baseline assessment is complete; the coordinator will not have access to the sequence.

Blinding. Participants and facilitators cannot be blinded to the display modality. The two raters of the seminar task will be blind to allocation: recordings will be labelled with codes only, show the participant in the real seminar room without any equipment, and be rated in random order with baseline and follow-up recordings mixed. Participants will be asked not to mention their training during the seminar task. The analyst will receive data with groups coded A and B until the primary analysis is complete. Raters will record their guess of each participant's group to assess blinding. Because raters have no role in participant safety, there are no circumstances that require unblinding them.

Data collection, management and analysis

Data collection. The seminar task is a standardised 15-minute session in a real seminar room in which team members act as lecturer and classmates following a script: a warm-up in which the lecturer asks two questions (minutes 0–3), an opening for the participant to ask a question (3–6), a group discussion (6–11), a 3-minute presentation by the participant on a topic agreed in advance (11–14) and questions on the presentation (14–15). Parallel forms with different topics will be used at each time point. Raters will be trained on five practice recordings until agreement reaches an ICC of at least 0.75 [17] before rating trial recordings. Questionnaires without validated Arabic versions will be translated and back-translated, with cognitive interviews during prototype testing.

Retention. Assessments will be scheduled flexibly, participants will receive reminders, and they will receive [a modest voucher] for each completed assessment. Outcome data will be sought from all participants, including those who stop the intervention.

Data management. Data will be entered into a password-protected database on an encrypted university computer, with range checks on entry and a double-entry check of 10% of records. Identifying information will be stored separately from study data and linked only by participant code.

Statistical methods. Feasibility outcomes will be reported descriptively with 95% confidence intervals and compared with the progression criteria in Table 4. For the candidate primary efficacy outcome and continuous secondary outcomes, the between-arm difference at week 15 will be estimated by analysis of covariance with the baseline value as a covariate, reported as an adjusted mean difference with a 95% confidence interval and

a standardised effect size. Count outcomes will be summarised descriptively. Harms will be reported by arm. Given the pilot design, no hypothesis tests will be used to judge effectiveness [10].

Analysis populations. The primary analysis will include all randomised participants in the group to which they were allocated (intention to treat). A per-protocol analysis restricted to participants attending at least 9 sessions will be reported as a sensitivity analysis.

Missing data. The extent and pattern of missing data will be reported by arm. The primary analysis will use available data; a sensitivity analysis will use multiple imputation under a missing-at-random assumption.

Additional analyses. No subgroup analyses are planned, because the sample is too small to support them. The proportion of correct group guesses by raters will be reported.

Table 4. Progression criteria for a definitive trial

Criterion	Proceed	Proceed with changes	Do not proceed without redesign
Recruitment	24 randomised by week 8	18–23	<18
Retention to week 15	≥80%	65–79%	<65%
Adherence (≥9 of 12 sessions)	≥75% of participants	60–74%	<60%
Serious adverse events related to the intervention	None	—	Any
Rater reliability (ICC)	≥0.75	0.60–0.74	<0.60

Monitoring

Data monitoring committee. A formal data monitoring committee is not considered necessary because the intervention is low risk, the trial is short and small, and participants are monitored at every session. Instead, an independent faculty member with expertise in research ethics, who is not involved in the trial, will review adverse events and protocol adherence monthly and may recommend pausing the trial. **Interim analyses.** No interim analyses of efficacy are planned. The trial will be paused if any serious adverse event related to the intervention occurs, pending review.

Trial monitoring. The trial management group will review recruitment, attendance, fidelity and adverse events weekly. The independent faculty member will check consent forms, eligibility and adverse event records for all participants.

Ethics and dissemination

Research ethics approval. The protocol will be submitted to the Institutional Review Board of [University] before any participant is approached; recruitment will not begin until approval is granted. The approval reference will be added to this protocol.

Protocol amendments. Important modifications will be submitted to the Institutional Review Board for approval, updated in the trial registry and OSF record with a new version number, and reported in the results publication.

Consent. A trained team member who does not deliver sessions to the participant will obtain written informed consent. Information will be provided in accessible Arabic and English, with an easy-read summary, and participants will have at least 48 hours to decide and may bring a trusted person. Separate consent will be

sought for video recording of the seminar tasks. Participation or withdrawal will not affect a student's grades or access to university services. No ancillary studies or biological specimens are planned.

Confidentiality. Data will be stored on encrypted, password-protected university computers in accordance with Jordan's Personal Data Protection Law, with access limited to the study team. Video recordings will be stored separately, used only for rating and deleted after rating and verification. No identifiable information will appear in any report.

Ancillary and post-trial care. Participants who experience distress will be offered immediate support and referral to the university counselling service. After the trial, participants in both arms will be offered access to the software. [Insurance and compensation arrangements for harm, as required by the sponsor.]

Discussion

This pilot trial addresses a practical question for universities: whether immersive VR adds value over the same training delivered on an ordinary screen. By holding software, content, facilitator time and real-world tasks constant across arms, the design isolates the effect of immersion, which most previous studies could not separate from attention and practice [5,6]. By measuring behaviour in a real seminar room, rated blind from video, it addresses the transfer gap that limits the existing literature [5,7].

The design has strengths. It uses an active, dose-matched comparator, blinded outcome assessment, pre-specified progression criteria, systematic assessment of harms and a neuroaffirming approach in which eye contact and tone are not scored. It is also the first trial of its kind in an Arabic-speaking setting, with bilingual content developed for Jordanian students.

There are limitations. The sample is small and drawn from a single site, so efficacy estimates will be imprecise and are intended only to inform a definitive trial. Follow-up is limited to two weeks after the intervention, so durability cannot be assessed. Participants and facilitators cannot be blinded, and self-logged real-class contributions may be subject to reporting bias. Software development and recruitment run in parallel within a short time frame, which is a risk mitigated by building a single module and freezing features in week 7.

If the progression criteria are met, the trial will provide the estimates needed to power a definitive multi-site trial, which could add a usual-support arm and longer follow-up. Whatever its result, the trial will indicate whether universities should invest in immersive headsets or in screen-based tools to support autistic students' participation in class.

Declarations

Ethics approval and consent to participate: see Ethics and dissemination; approval reference [pending].

Consent for publication: not applicable. **Availability of data and materials:** see Data sharing. **Competing**

interests: none declared. **Funding:** [statement]. **Authors' contributions:** see Administrative information.

Acknowledgements: [to be completed].

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Supplementary Table S2. SPIRIT 2025 checklist

All 53 SPIRIT 2025 item entries (34 numbered items) are addressed. Item wording abbreviated; see Chan et al., 2025 [18].

Item	Description	Where addressed
1a	Title: design, population, interventions; identified as protocol	Title page
1b	Structured summary incl. WHO Trial Registration Data Set	Abstract; Table S1
2	Protocol version date and identifier	Title page; Administrative information
3a	Names, affiliations and roles of contributors	Title page; Administrative information
3b	Sponsor name and contact	Administrative information
3c	Role of sponsor and funders	Administrative information
3d	Coordinating and oversight groups	Administrative information; Monitoring
4	Trial registration	Open science: Trial registration
5	Access to protocol and statistical analysis plan	Open science: Protocol and SAP
6	Data sharing	Open science: Data sharing
7a	Sources of funding and support	Open science: Funding
7b	Conflicts of interest	Open science: Funding; Declarations
8	Dissemination policy	Open science: Dissemination policy
9a	Background and rationale, benefits and harms	Introduction: Background and rationale
9b	Choice of comparator	Introduction: Choice of comparator
10	Objectives related to benefits and harms	Introduction: Objectives
11	Patient and public involvement	Methods: Patient and public involvement
12	Trial design, allocation ratio, framework	Methods: Trial design
13	Setting and locations	Methods: Trial setting
14a	Participant eligibility	Methods: Eligibility criteria
14b	Eligibility of those delivering interventions	Methods: Eligibility criteria
15a	Intervention and comparator, replicable detail	Methods: Intervention and comparator; Table 1
15b	Criteria for discontinuing or modifying	Methods: Intervention and comparator
15c	Adherence strategies and monitoring	Methods: Intervention and comparator
15d	Concomitant care	Methods: Intervention and comparator
16	Outcomes: variable, metric, aggregation, time point	Methods: Outcomes; Table 2
17	Harms definition and assessment	Methods: Harms
18	Participant timeline and schedule	Methods: Participant timeline; Table 3
19	Sample size and assumptions	Methods: Sample size
20	Recruitment strategies	Methods: Recruitment
21a	Who generates the sequence and method	Methods: Assignment of interventions
21b	Type of randomisation; restriction details held separately	Methods: Assignment of interventions
22	Allocation concealment mechanism	Methods: Assignment of interventions
23	Implementation and access to sequence	Methods: Assignment of interventions
24a	Who is blinded	Methods: Blinding
24b	How blinding is achieved	Methods: Blinding
24c	Unblinding circumstances	Methods: Blinding

Item	Description	Where addressed
25a	Data collection, quality, instruments	Methods: Data collection
25b	Retention and follow-up of discontinuers	Methods: Retention
26	Data management	Methods: Data management
27a	Statistical methods incl. harms	Methods: Statistical methods
27b	Analysis populations	Methods: Analysis populations
27c	Missing data	Methods: Missing data
27d	Additional analyses	Methods: Additional analyses
28a	Data monitoring committee or justification	Methods: Monitoring
28b	Interim analyses and stopping guidelines	Methods: Monitoring
29	Trial monitoring	Methods: Monitoring
30	Ethics approval plans	Ethics and dissemination
31	Protocol amendments	Ethics and dissemination
32a	Who obtains consent and how	Ethics and dissemination: Consent
32b	Consent for ancillary studies	Ethics and dissemination: Consent (not applicable)
33	Confidentiality	Ethics and dissemination: Confidentiality
34	Ancillary and post-trial care; compensation	Ethics and dissemination: Ancillary and post-trial care

Supplementary Table S1. WHO Trial Registration Data Set (summary)

Field	Entry
Primary registry and trial number	ClinicalTrials.gov; [pending]
Date of registration	[pending; before first enrolment]
Source of funding / sponsor	[Funding]; [University]
Contact for public and scientific queries	[Name, email]
Public title	Virtual classroom training for autistic university students
Scientific title	Immersive versus screen-based virtual classroom training for academic interaction among autistic university students in Jordan: a pilot randomised controlled trial
Countries of recruitment	Jordan
Health condition studied	Autism
Interventions	Immersive VR virtual classroom training; comparator: identical training on a standard screen
Key inclusion and exclusion criteria	Enrolled autistic university students aged ≥ 18 ; excluding photosensitive epilepsy
Study type	Interventional, randomised, parallel-group, assessor-blinded pilot trial
Date of first enrolment	[Week 3 of project]
Target sample size	24
Recruitment status	Not yet recruiting
Primary outcomes	Feasibility: recruitment, retention, adherence, harms, rater reliability
Key secondary outcomes	Verbal contributions in a live seminar task; presentation quality; public-speaking anxiety; cybersickness; usability