Design and procedure

How the trial was set up and delivered in schools

Jane E. Boyle, Johnmarshall Reeve, Geetanjali Basarkod, and Jiesi Guo · Institute for Positive Psychology and Education, Australian Catholic University

Version 1.1 · October 2026 · Licence: CC BY 4.0 · osf.io/5hjdz

Trial design

A randomized controlled 2 × 2 factorial design crossed role modelling (present vs. absent) with goal setting (present vs. absent), producing four conditions: active control, goal setting only, role modelling only, and combined. Students were individually randomized within classes. Data were collected between July and August 2025 in a single scheduled class session: baseline survey, 35 minutes of online intervention content, and posttest survey. Every condition had access to a condition-specific chatbot.

Procedure

1. **Consent and assent**
   Schools distributed the participant information letter and collected parent consent through their own online consent platform. Students read an information screen and gave assent in REDCap before taking part.

2. **Baseline (T1)**
   At the start of the class session, students completed demographic and background questions and the SEVT motivation survey (Document 05).

3. **Randomization**
   REDCap's randomization module assigned each student to one of the four conditions, using an unblocked allocation table generated by computer script before data collection. Research staff could not view the table or anticipate the next allocation, and students and teachers were not informed of condition assignments.

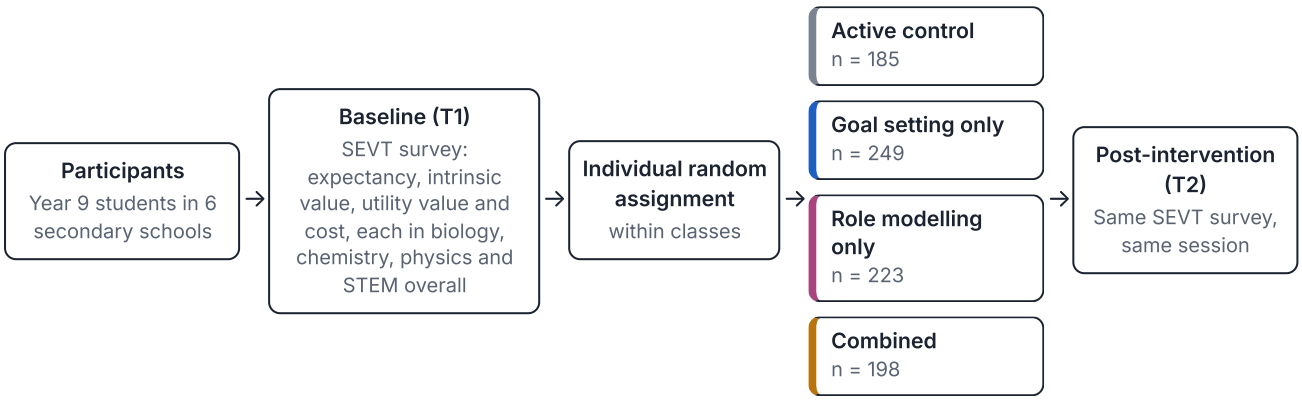
4. **Intervention**
   In the same session, students completed the online content for their condition (Document 03). A read-only numeric chatbot ID shown on screen was entered into the chatbot so that students could talk with STEMGuide (Document 04). A research-team member was present to help with technical issues; students stayed on each role-model video page for at least one minute.

5. **Post-intervention (T2)**
   Immediately afterwards, in the same session, students answered two manipulation-check items and completed the SEVT survey again.

Newcomers. Students who missed the scheduled session (e.g., excursions, sport, illness, technical problems) completed the same sequence when they next attended and were randomized the same way (192 students, 22.5% of the analytic sample; balanced across conditions, $\chi^2(3) = 0.57$, $p = .904$, and school locations, $\chi^2(1) = 2.11$, $p = .147$).

Figure 1. STEM intervention design and condition content

Panel A. Trial design and process



Panel B. Condition content and dose

Active control

- Four TED-Ed videos on general-interest, non-STEM topics
- Three engagement items after each video (12 in total), answered Yes/No or on a No–Yes slider:
  - attention, focus and concentration
  - engagement, mood and strength of feeling
  - ease of viewing and confidence
  - mental effort and thinking required
  - whether the video was a good use of time
- General-content chatbot

Goal setting (GS) only

- Three introductory videos
- Task-value prompt
- Effort, help-seeking and prior-goals questions
- Worked SMART example
- SMART goal construction
- Goal review
- Strategy choices and if–then plan
- Goal-setting chatbot

Role modelling (RM) only

- Five women-in-STEM role-model videos (ATSE)
- Four career-rating items after each video:
  - confidence of succeeding in that career
  - interest in it
  - usefulness for future goals
  - manageability of its costs
- Choice of the most inspiring video
- Role-model chatbot

Combined

- Abbreviated goal-setting sequence
- One of three introductory videos (SMART goals)
- Task-value prompt
- Effort, help-seeking and prior-goals questions
- Worked SMART example and SMART goal construction
- *Goal review, strategy choices and if–then plan omitted*
- Three of five role-model videos
- Four career-rating items after each video, as in RM only
- Combined chatbot

SEVT = situated expectancy-value theory; ATSE = Australian Academy of Technological Sciences and Engineering. All four conditions were delivered online within a single scheduled class session, with 35 minutes of intervention content per condition and a condition-specific chatbot available in every condition. Holding session time constant meant the combined condition received a reduced dose of both components. *n* = students analyzed per condition.

Condition content and planned dose

To keep session time constant, the combined condition delivered a shorter version of each component: three of the five role-model videos, one of the three goal-setting videos (the one explaining the SMART framework) with the worked SMART example, and the SMART goal without the goal review, strategy choices, or if–then plan.

Table 1. Condition content and planned dose

Component element	Active control	GS only	RM only	Combined
Introductory videos (STEM importance, SMART goals, setting goals)	—	3 videos	—	1 of 3 (SMART goals)

Component element	Active control	GS only	RM only	Combined
Task-value prompt (open written response on STEM relevance)	—	1 prompt	—	1 prompt
Effort, help-seeking and prior-goals questions	—	3 items	—	3 items
SMART goal (5 elements, menu or own wording)	—	5 elements	—	5 elements (different menu options)
Worked SMART example (shown on the page)	—	1	—	1
Goal review (specific, timeframes, measurable, achievable, effort, realistic)	—	6 ratings	—	Not delivered
Strategy choices (distraction, difficulty)	—	2 items	—	Not delivered
Free-text rewrite of goal with if–then plan	—	6 fields	—	Not delivered
Closing items (obstacles, open to adjusting, confidence)	—	3 items	—	Not delivered
Role-model videos (ATSE, women in STEM, ≈ 3 min each)	—	—	5 videos	3 videos
Post-video career ratings (4 items per video)	—	—	20 responses	12 responses
Most inspiring video (single choice)	—	—	1 item	1 item
Active-control videos (TED-Ed)	4 videos	—	—	—
Post-video response items (e.g., engagement, attention, ease, effort, use of time)	12 items (3 per video)	—	—	—
Condition-specific chatbot (GPT-4o)	Available	Available	Available	Available
SEVT survey (12 items × 4 domains, T1 and T2)	48 × 2	48 × 2	48 × 2	48 × 2
Session length	35 min content	35 min content	35 min content	35 min content

Dash = not part of that condition; not delivered = present in the single-component condition but omitted from the combined condition. The combined condition's goal menus offered a different and longer set of options than the GS-only menus (67 options across the five SMART elements against 41, each including an "Other" entry). GS = goal setting; RM = role modelling.

Platform and instruments

All content was delivered in REDCap (Australian Catholic University instance) as a sequence of survey instruments in one class session; videos were embedded from YouTube and the chatbot was embedded as a chat widget (orange chat button, bottom-right of the screen).

Stage	REDCap instrument	Content
Baseline	Form 1	Participant information and student assent
Baseline	Survey 1 Demographics	Gender, age, school location (regional/metropolitan, as worded in REDCap), home postcode, student email (used only to save progress)
Baseline	Survey 1 Baseline	Perceived family wealth, own bedroom, quiet place to study, parent occupation, intended senior STEM subjects

Stage	REDCap instrument	Content
Baseline	Survey 1 SEVT A–D	SEVT motivation survey, T1 (Document 05)
Randomization	Survey 1 Randomiser	Allocation to Control, Goal-Setting, Role Model or Combined
Intervention	Condition instruments	Active Control Part A; GS Intervention Part A + GS Part A; RM Intervention Part A; Combined Intervention 1 and 2 Part A (Document 03)
Posttest	Survey 2 Manipulation Checks	Two yes/no items (Document 03)
Posttest	Survey 2 SEVT A–D	SEVT motivation survey, T2 (Document 05)

Registration and analysis

Registration

- Registered on OSF on 5 June 2026, after data collection but before the research team accessed or analyzed the data.
- Modified intention-to-treat sample: 855 of 865 randomized students (10 students reporting a non-binary gender identity could not be included in models with gender as a binary covariate).

Analysis

- Longitudinal latent SEM (lavaan, R) with scalar invariance across time and gender.
- T2 outcomes adjusted for T1, gender, newcomer status and school location (rural vs. urban); robust ML, FIML for missing data, school-clustered standard errors; Benjamini–Hochberg correction within outcome families.

How to cite: Boyle, J. E., Reeve, J., Basarkod, G., & Guo, J. (2026). *Psychosocial RCT on STEM Motivation: Intervention materials and resources* [Open materials]. Open Science Framework. https://osf.io/5hjdz
Licensed under Creative Commons Attribution 4.0 International (CC BY 4.0), except third-party videos, which are linked and remain under their owners' terms, and adapted survey items, whose original sources are cited.