Clinical Trial Protocol
Iranian Registry of Clinical Trials

08 Nov 2026

Investigating and comparing the effects of an educational escape room based on Error Management Training and Error Avoidance Training on situational motivation, cognitive effort, and adaptive performance of dental students

Protocol summary

Study aim

To investigate and compare the effects of an educational escape room based on error management training versus error avoidance training on situational motivation, cognitive effort, and adaptive performance of dental students.

Design

Two-arm parallel group randomized educational clinical trial with double-blind design. Phase 2 on 70 students. Randomization will be performed using the random function of SPSS software.

Settings and conduct

Context: Escape room with missions related to dental trauma, Setting: Tehran School of Dentistry Method: Two identical escape rooms differ only in gameplay (errors allowed vs. not). Effects on main variables are measured post-intervention using appropriate tools. Blinding: Statistician blinded to group data. Participants unaware of structural differences between rooms (in order to enhance the internal validity of the intervention, according to the reference on research in educational studies). The most important ethical principle: Post-study debriefing fully explains the research aim, group differences, and emphasizes that performance differences reflect data for improving education, not individual ability.

Participants/Inclusion and exclusion criteria

Inclusion criteria: Dental students in the 11th semester. Non-inclusion criteria: Previous training in error management, use of medications, and psychological problems that impair concentration and motivation such as depression.

Intervention groups

In the control group (error avoidance training), students solve the escape room missions using a step by step guideline, while students in the intervention group (error management training) must solve the same missions through trial and error.

Main outcome variables

After the escape rooms, their effects on three variables, situational motivation, cognitive effort, and adaptive performance, will be assessed using appropriate instruments and compared.

General information

Reason for update

Acronym

IRCT registration information

IRCT registration number: **IRCT20190922044844N2**
Registration date: **2026-06-21, 1405/03/31**
Registration timing: **prospective**

Last update: **2026-06-21, 1405/03/31**
Update count: **0**

Registration date

2026-06-21, 1405/03/31

Registrant information

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Name of organization / entity

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Recruitment status

Recruitment complete

Funding source

Expected recruitment start date
2026-10-18, 1405/07/26
Expected recruitment end date
2026-10-18, 1405/07/26
Actual recruitment start date
empty
Actual recruitment end date
empty
Trial completion date
empty

Scientific title
Investigating and comparing the effects of an educational escape room based on Error Management Training and Error Avoidance Training on situational motivation, cognitive effort, and adaptive performance of dental students

Public title
Comparison of the Effectiveness of Two Educational Approaches, Error Avoidance and Error Management, in the Escape Room
Purpose
Education/Guidance
Inclusion/Exclusion criteria
Inclusion criteria:
Dental student in their 11th semester
Exclusion criteria:
They have previously participated in training courses related to error management theory. They take medication that disrupts concentration (self-reported). They report psychological problems such as depression that may affect motivation or concentration (self-reported).
Age
From **18 years** old
Gender
Both

Phase
N/A
Groups that have been masked

- Participant
- Data analyser

Sample size
Target sample size: **70**
Randomization (investigator's opinion)
Randomized
Randomization description
* Study Randomization Method: Non-random purposive sampling, selecting all 11th-semester dental students as the accessible population aligned with the study objectives. * Random allocation to control and intervention groups * Unit of randomization: Individual (each student). * Randomization method: Stratified randomization with 4 strata: 1. Male students with a history of participation in an escape room. 2. Male students without a history of participation in an escape room. 3. Female students with a history of participation in an escape room. 4. Female students without a history of participation in an escape room. * Randomization software: SPSS. * Randomization procedure: 1. The number of students in each stratum is determined; for example, there are 20 male students with a history of escape room participation. 2. Each stratum is independently blocked and divided. For instance, each of the 20 male students with a history is assigned a random number (a decimal between 0 and 1, such as 0.7, 0.48, etc.). Using these numbers and the random function in SPSS, these 20 students are divided into blocks of 4 and 6. When we enter the student ID numbers into the software, SPSS randomly selects 4 students as the first block. The first 2 of these 4 randomly selected students are assigned to the control group, and the next 2 are assigned to the intervention group. The second block consists of 6 students; SPSS randomly selects 6 students (from the same stratum of 20 male students with a history) and the first 3 are placed in the control group and the next 3 in the intervention group. The third block is a 4-block, and this blocking process continues until all students in that stratum are fully allocated. Students in the other strata are similarly and independently divided using the same method. Ultimately, both the control and intervention groups will have equal numbers of male students with and without escape room experience, as well as female students with and without such experience. * Complementary note: Since the escape room game is group-based, both the control and intervention groups need to be further divided into smaller teams. The same randomization procedure described above is again applied to allocate the students in each group into 5 teams of 7 members each. * Allocation concealment: The allocation of groups is performed by a statistician in the days prior to the implementation, determining which group (control or intervention) and which team (Team 1 to 5) each student belongs to. This data is placed in a sealed envelope. The envelope remains with the statistician until the day of the implementation. On the day of the intervention, the envelope is handed over to the educational expert (from the execution team), who then groups the students waiting in the quarantine room based on the data contained inside the envelope.
Blinding (investigator's opinion)
Double blinded
Blinding description
Students in the two groups will be separated using entry and exit quarantine rooms and will not know which type of escape room they are in (single-blind design). The statistician will also be blinded to the allocation of data between the intervention and control groups during analysis (double-blind study).
Placebo
Not used
Assignment
Parallel
Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee

Name of ethics committee

Ethics Committee for Research at Tehran University of Medical Sciences

Street address

Rooms 604-605, 6th Floor, Central Headquarters, Tehran University of Medical Sciences, corner of Quds Street, Keshavarz Boulevard,

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Approval date

2025-11-09, 1404/08/18

Ethics committee reference number

IR.TUMS.DENTISTRY.REC.1404.074

Health conditions studied

1

Description of health condition studied

Game-based learning, Educational escape room, Error management training

ICD-10 code

ICD-10 code description

Primary outcomes

1

Description

Situational motivation is the motivation that individuals experience during an activity (in the same time and place).

Timepoint

Once, immediately after the escape room.

Method of measurement

It will be measured using the Situational Motivation Scale (SIMS), which will be translated into Persian for this study.

2

Description

Cognitive effort refers to a set of intervening processes that individuals use when confronted with a task, acting as a mediator between task features and one's processing capacity.

Timepoint

Once, immediately after the escape room.

Method of measurement

Cognitive effort is assessed using the Mental Effort Rating Scale (Persian version).

3

Description

Adaptive performance is the ability of individuals to adapt their performance to a changing, challenging, and novel environment.

Timepoint

Once, immediately after the escape room.

Method of measurement

It will be measured using the Individual Adaptive Performance Scale, which will be translated into Persian in this study.

Secondary outcomes

empty

Intervention groups

1

Description

Control group:In the week prior to the implementation, the educational content related to dental trauma is made available to the participants through the Navid system (according to the instructor's lesson plan, this is a virtual session and is independent of the implementation, or the presence or absence of students in the study), and they are required to study this content offline in accordance with the curriculum. Then, students who consent to participate in the study declare their readiness, and are subsequently divided into control and intervention groups through stratified sampling, with each group further divided into 5 teams of 7 (assuming no attrition). The required sample size for the study is 48 participants (24 per group), which was estimated as 70 participants (35 per group) to account for a 30% attrition rate. On the designated day, participants arrive at the dental school and gather in the quarantine room. The escape room story and the learning objectives are explained to them via a video and an expert's talk (the lecture step).Escape room name: The Runaway Student.Escape room story: A student has incorrectly treated the dental trauma of two 3-year-old patients. Now, seeking revenge, he has uploaded a virus into the educational system that will erase all students' information within a few hours. Participants must go to the escape rooms to find the code to disable the virus.Participants are assigned to their teams by the educational expert; then, the first team leaves the quarantine room and heads to the control escape room. There, the rules of the control escape room are first explained (the briefing step): for each mission, there is an envelope called the "guide envelope" that contains a clue for the answer to that mission. The members of each team must collaboratively solve the first 5 missions with the help of the instructions. These missions consist of 5 paper-based games related to the diagnosis and treatment of the two dental traumas that the runaway student misdiagnosed. The final mission is a scenario in which they must find the mistakes made by the runaway student; at this stage, they receive no guidance or instructions. They show their answers to the operator present in the room, who checks them against a checklist. The number of errors in this stage is recorded by the operator. Additionally, the duration of the final game is recorded

by the operator using a mobile phone timer or chronometer. There are rescue cards available, which participants can purchase using digital currency (hypothetical money given to them before entering the escape room) if they get stuck on a particular stage and are unable to reach the correct answer, allowing them to bypass that stage. The total time for the escape room for each team is 30 minutes. If they successfully complete the final game, the operator gives them the virus code; otherwise, they must leave the room without receiving the code. Afterwards, they proceed to the reporting room, where they reflect on their experience and the learning objectives of the study, facilitated by an educational expert. They then complete the study-related questionnaires and leave the venue. When the first team is in the reporting room, the second team enters the escape room.

Category

Other

2

Description

Intervention group:This group, like the control group, enters the quarantine room, undergoes the lecture step, and is assigned to 5 teams of 7. Then, the first team leaves the quarantine room and heads to the intervention escape room. In the briefing step, the rules of the escape room are explained: in this escape room, they are allowed to make mistakes and learn through trial and error. For each mission, they receive feedback after every mistake (incorporated into the game itself). Throughout the first 5 missions, they are actively encouraged to use trial and error. These 5 missions are exactly the same as those in the control escape room, with the difference that the control room provides instructions or guide cards, whereas the intervention room replaces those guides with feedback after errors. In the final mission, they are explicitly told that they are not permitted to make errors. They are given the same scenario as the control group, and the operator records the number of errors and the time taken for this final game. This group also has digital currency and rescue cards available. If they succeed, they will receive the virus code. The total time for the escape room for each team is 30 minutes. Afterward, they proceed to the reporting room, where they reflect on their experience and the learning objectives of the study, facilitated by an educational expert. They then complete the study-related questionnaires and leave the venue. When the first team is in the reporting room, the second team enters the escape room.

Category

Other

Recruitment centers

1

Recruitment center

Name of recruitment center

School of Dentistry, Tehran University of Medical Sciences

Full name of responsible person

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Sponsors / Funding sources

1

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Grant name

Grant code / Reference number

Is the source of funding the same sponsor organization/entity?

Yes

Title of funding source

Tehran University of Medical Sciences

Proportion provided by this source

100

Public or private sector

Public

Domestic or foreign origin

Domestic

Category of foreign source of funding

empty

Country of origin

Type of organization providing the funding

Academic

Person responsible for general inquiries

Contact

Name of organization / entity
Tehran University of Medical Sciences

Full name of responsible person
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Latest degree
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Sharing plan

Deidentified Individual Participant Data Set (IPD)
No - There is not a plan to make this available

Justification/reason for indecision/not sharing IPD
For reasons of confidentiality, the data will be solely accessible to the research team, and only the parts pertaining to the article will be disclosed.

Study Protocol
No - There is not a plan to make this available

Statistical Analysis Plan
No - There is not a plan to make this available

Informed Consent Form
No - There is not a plan to make this available

Clinical Study Report
No - There is not a plan to make this available

Analytic Code
No - There is not a plan to make this available

Data Dictionary
No - There is not a plan to make this available