

# Clinical Trial Protocol

## Iranian Registry of Clinical Trials

15 Jun 2026

### Comparing the Effectiveness of Microlearning and Flipped Classroom Approaches on Learning Arterial Blood Gas Analysis and Motivation of Anesthesia Students Based on Kirkpatrick's Model

#### Protocol summary

##### Study aim

Comparing the Effectiveness of Microlearning and Flipped Classroom Approaches on Learning Arterial Blood Gas Analysis and Motivation of Anesthesia Students Based on Kirkpatrick's Model

##### Design

A quasi-experimental study with a pre-test and post-test design and a sample size of 50 participants.

##### Settings and conduct

Anesthesia students at the School of Allied Medical Sciences of Tehran University of Medical Sciences, after registration, will be invited to the first session, during which the pre-test and motivation will be assessed, and for the next sessions, the students will be divided into two intervention groups. At the end of the course, the post-test, motivation, and satisfaction will be assessed, and in the next phase, the students will be evaluated in the clinical setting, and the assessor will evaluate the students in a single-blind manner.

##### Participants/Inclusion and exclusion criteria

Inclusion Criteria: B.Sc student of anesthesia.  
Registration in the arterial blood gas analysis workshop.  
Exclusion Criteria: participation in other workshops related to arterial blood gas interpretation in the past.

##### Intervention groups

Instruction on interpreting arterial blood gas test results and related parameters will be delivered in four 2-hour sessions over four weeks. The first session is identical for all participants and uses the traditional method, and the remaining three sessions are delivered separately to each intervention group. Intervention group 1: Educational content is delivered via micro-learning (three sessions) using short videos and posters available after each session. Intervention group 2: Educational content is delivered via the flipped classroom method (three sessions), with handouts provided one week before class and in-class time devoted to group work.

#### Main outcome variables

Knowledge of arterial blood gas interpretation; satisfaction with the teaching method; motivational strategies for learning

#### General information

##### Reason for update

##### Acronym

##### IRCT registration information

IRCT registration number: **IRCT20260214068860N1**  
Registration date: **2026-05-02, 1405/02/12**  
Registration timing: **prospective**

Last update: **2026-05-02, 1405/02/12**

Update count: **0**

##### Registration date

2026-05-02, 1405/02/12

##### Registrant information

##### Name

shaghayegh miri

##### Name of organization / entity

##### Country

Iran (Islamic Republic of)

##### Phone

+98 71 3623 6983

##### Email address

miri-sh@razi.tums.ac.ir

##### Recruitment status

**recruiting**

##### Funding source

##### Expected recruitment start date

2026-05-04, 1405/02/14

##### Expected recruitment end date

2026-08-07, 1405/05/16

##### Actual recruitment start date

empty  
**Actual recruitment end date**  
empty  
**Trial completion date**  
empty  
**Scientific title**  
Comparing the Effectiveness of Microlearning and Flipped Classroom Approaches on Learning Arterial Blood Gas Analysis and Motivation of Anesthesia Students Based on Kirkpatrick's Model

**Public title**  
Comparing two teaching methods for learning arterial blood gases analysis  
**Purpose**  
Education/Guidance  
**Inclusion/Exclusion criteria**  
**Inclusion criteria:**  
B.Sc student of anesthesia. Register for the arterial blood gas analysis workshop. Willingness to participate in the study.  
**Exclusion criteria:**  
participation in other workshops related to arterial blood gas interpretation in the past.

**Age**  
No age limit

**Gender**  
Both

**Phase**  
N/A

**Groups that have been masked**  
*No information*

**Sample size**  
Target sample size: **50**

**Randomization (investigator's opinion)**  
Not randomized

**Randomization description**

**Blinding (investigator's opinion)**  
Not blinded

**Blinding description**

**Placebo**  
Not used

**Assignment**  
Parallel

**Other design features**

## Secondary Ids

empty

## Ethics committees

### 1

**Ethics committee**

**Name of ethics committee**  
Ethics Committee of Faculty of Public Health, Tehran University of Medical Sciences,

**Street address**  
School of Public Health, Poursina St., Qods St., Enghelab Ave.

**City**  
Tehran  
**Province**  
Tehran  
**Postal code**  
1471613151

**Approval date**  
2025-06-29, 1404/04/08  
**Ethics committee reference number**  
IR.TUMS.SPH.REC.1404.081

## Health conditions studied

### 1

**Description of health condition studied**  
Microlearning educational approach / Flipped classroom educational approach

**ICD-10 code**  
Z55

**ICD-10 code description**  
Problems related to education and literacy

## Primary outcomes

### 1

**Description**  
Knowledge of arterial blood gas interpretation (Kirkpatrick level 2)

**Timepoint**  
Before the intervention and seven days after the intervention.

**Method of measurement**  
pre-test and post-test consist of 20 multiple-choice questions.

### 2

**Description**  
Students' satisfaction (Kirkpatrick level 1).

**Timepoint**  
Immediately after the intervention.

**Method of measurement**  
A researcher-made questionnaire.

### 3

**Description**  
motivational strategies.

**Timepoint**  
Before the intervention, one week after the intervention, and three months after the intervention.

**Method of measurement**  
Motivated Strategies for Learning Questionnaire

## Secondary outcomes

### 1

**Description**  
Change in students' clinical behavior (Kirkpatrick level

3).

**Timepoint**

3 months after the end of the intervention.

**Method of measurement**

Evaluation by the examiner at the clinical setting using a patient arterial blood gas test sheet.

**Intervention groups****1****Description**

Intervention group 1: microlearning method. Over a 3-week period, following each of the three weekly 2-hour arterial blood gas analysis training sessions delivered in a lecture format, microlearning content will be provided to the participants in this group to reinforce the taught material. This content includes short videos and podcasts, usually less than 15 minutes, infographics, and brief online quizzes, which are delivered via interactive media and digital tools in the intervals between sessions until the next class. The educational content of the sessions includes instruction on arterial blood gas report parameters, the approach to analysis and diagnosis of acid-base disorders, and the principles of their treatment.

**Category**

N/A

**2****Description**

Intervention group 2: flipped classroom method; In this instructional approach, over a three-week period, materials related to arterial blood gas analysis are provided to the students in the form of handouts and booklets one week before each of the three workshop sessions, so that they can study them before the class begins. The students then attend face-to-face sessions for 2 hours, during which they consolidate their knowledge through gamification and team-based learning, while the instructor acts as a facilitator. The session content includes instruction on arterial blood gas report parameters, the approach to analysis and diagnosis of acid-base disorders, and the principles of their management.

**Category**

N/A

**Recruitment centers****1****Recruitment center****Name of recruitment center**

Tehran University of Medical Sciences, School of Allied Medical Sciences

**Full name of responsible person**

Dr. Reza Safdari

**Street address**

No. 17, Mohammad Ebrahim Bastani Parizi Alley, Ghods Street, Enghelab Street, Enghelab Square,

Tehran

**City**

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**Province**

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**Postal code**

14177-44361

**Phone**

+98 21 8898 3025

**Email**

Mirishaghayegh79@gmail.com

**Sponsors / Funding sources****1****Sponsor****Name of organization / entity**

Tehran University of Medical Sciences

**Full name of responsible person**

Dr. Ramin Kordi

**Street address**

Keshavarz Boulevard, corner of Ghods Street, Central Administration Building of the University, 6th Floor, Deputy for Research and Technology, Tehran, Iran.

**City**

Tehran

**Province**

Tehran

**Postal code**

141765383761

**Phone**

+98 21 8163 3698

**Email**

vcr@tums.ac.ir

**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**

Shaghayegh Miri

**Position**

Master's student

**Latest degree**

Bachelor

**Other areas of specialty/work**

Medical Education

**Street address**

No. 17, Mohammad Ebrahim Bastani Parizi Alley,  
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## Person responsible for scientific inquiries

**Contact**

**Name of organization / entity**

Tehran University of Medical Sciences

**Full name of responsible person**

Shaghayegh Miri

**Position**

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Bachelor

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## Person responsible for updating data

**Contact**

**Name of organization / entity**

Tehran University of Medical Sciences

**Full name of responsible person**

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**Position**

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## Sharing plan

**Deidentified Individual Participant Data Set (IPD)**

Undecided - It is not yet known if there will be a plan to make this available

**Study Protocol**

Yes - There is a plan to make this available

**Statistical Analysis Plan**

Yes - There is a plan to make this available

**Informed Consent Form**

Yes - There is a plan to make this available

**Clinical Study Report**

Yes - There is a plan to make this available

**Analytic Code**

Undecided - It is not yet known if there will be a plan to make this available

**Data Dictionary**

Undecided - It is not yet known if there will be a plan to make this available

**Title and more details about the data/document**

All study results are available for sharing after protecting personal information and maintaining confidentiality principles.

**When the data will become available and for how long**

Data access will begin 6 months after publication of the results.

**To whom data/document is available**

The data will be available to researchers working in academic and scientific institutions.

**Under which criteria data/document could be used**

If sufficient justification is provided, the research team will decide on the release of the requested documents related to this topic.

**From where data/document is obtainable**

After publication of the article, the corresponding author's contact information will be made available, and interested individuals may submit their requests by contacting the corresponding author.

**What processes are involved for a request to access data/document**

After contacting the corresponding author and reviewing the matter with the research team, and with permission from the relevant higher authority, a decision will be made regarding the release of the documents.

**Comments**