Clinical Trial Protocol
Iranian Registry of Clinical Trials

07 Nov 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

Recruitment complete

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

Tehran

Province

Tehran

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, Ghods Street, Enqelab Street, Enqelab Square, Tehran, Iran

City

Tehran

Province

Tehran

Postal code

14177-44361

Phone

+98 21 8898 3025

Email

Mirishaghayegh79@gmail.com

Person responsible for scientific 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, Ghods Street, Enqelab Street, Enqelab Square, Tehran, Iran

City

Tehran

Province

Tehran

Postal code

14177-44361

Phone

+98 21 8898 3025

Email

Mirishaghayegh79@gmail.com

Person responsible for updating data

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, Ghods Street, Enqelab Street, Enqelab Square, Tehran, Iran

City

Tehran

Province

Tehran

Postal code

14177-44361

Phone

+98 21 8898 3025

Email

Mirishaghayegh79@gmail.com

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