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Innovative learning strategy of oral histology course for dental students

Submission date
08/03/2023

Recruitment status
No longer recruiting

Registration date
23/03/2023

Overall study status
Completed

Last Edited
01/04/2026

Condition category
Oral Health

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[X] Results
[ ] Individual participant data

Plain English summary of protocol

Background and study aims
A practicum basic oral biology course is given in the first semester of the dental undergraduate curriculum. Evaluation is routinely conducted at the end of the semester. During evaluation in 2019-2020, it was revealed that a third of students perceived oral histology as difficult and did not feel confident with their understanding of oral histology. The learning strategy at that time was in-campus or online practicum using histological slides to identify the microscopic structures of the orocraniofacial (mouth/head/face) tissues. The implementation of innovative learning strategies was intended to increase students' understanding of oral histology and improve the learning experience. This study aimed to evaluate the impact of serious games (HistoRM games) on student understanding of oral histology and learning experiences.

Who can participate?
Undergraduate first-year dental students studying the basic oral biology practicum course in the first semester of the dental curriculum of the 2022/2023 academic year.

What does the study involve?
The intervention includes the HistoRM games and the practicum handouts (script-based) for 7 and 14 days. At the end of the study, participants are asked to fill out a survey to evaluate their understanding of the learning material and learning experiences.

What are the possible benefits and risks of participating?
There were no risks and student participation was voluntary. Research assistants were assigned for the recruitment of participants to avoid conflicts of interest. The innovative learning strategy could help students to understand the learning materials

Where is the study run from?
Universitas Indonesia (Indonesia)

When is the study starting and how long is it expected to run for?
February 2022 to December 2022

Who is funding the study?
Universitas Indonesia (Indonesia)

Who is the main contact?
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Contact information

Type(s)
Principal investigator

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Additional identifiers

Protocol serial number
011331022

Study information

Scientific Title
Serious games of oral histology learning strategy for undergraduate dental students; crossover randomized controlled trial

Study objectives
Serious Games as an innovative learning approach could increase student understanding of oral histology and overall improve the learning experience.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 27/10/2022, Dental Research Ethics Commission (KEPKG) Faculty of Dentistry, University of Indonesia (Jalan Salemba Raya No. 4, Jakarta Pusat, Jakarta, 10430, Indonesia; +62-21 31906289; etikrisetfkg@ui.ac.id), ref: 87/ethical approval/FKGUI/X/2022

Primary study design
Interventional

Study design
Crossover randomized controlled trial

Study type(s)
Other

Health condition(s) or problem(s) studied
Oral histology learning strategy for undergraduate dental students

Interventions
Study Designs and Participants
The design of this study was a crossover randomized controlled trial. Ethical approval was obtained from Dental Research Ethics Committee Universitas Indonesia (87/ethical approval /FKGUI/X/2022). Study participants were undergraduate 1st-year dental students who studied the Basic Oral Biology Practicum course in the 1st semester of the 2022/2023 academic year. Third-year dental students (ICL and SND) were involved in the recruitment of study participants and their participation was voluntary based. All respondents filled out the informed consent.

Students were randomly divided into two groups utilizing the randomized block method. Pre-tests were given before the study started to evaluate their prior knowledge. Two learning materials were prepared with complementary learning of HistoRM games, topic 1 was the histology of oral mucosa, and topic 2 was the histology of tooth and its supporting structure. The intervention included the HistoRM games and the practicum handouts (script-based). Group A played HistoRM games of topic 1 for three days and was later given the practicum handouts, while group B received the practicum handouts of topic 1 in the first three days and played HistoRM games between days 3-7. After three days, students in groups A and B could access both interventions. A post-test evaluation was carried out on day 3 and day 7. The experimental study was repeated for topic 2. In the first three days, group A received the practicum handouts while group B played HistoRM games, implementing the cross-over experimental design. Similarly, after three days of learning topic 2, students in groups A and B could access both interventions. At the end of the study, participants were asked to fill out a survey to evaluate their understanding of the learning material and learning experiences.

Learning Materials
Practicum basic oral biology course is given in the 1st semester of the dental undergraduate curriculum. The lecture learning outcomes at the end of the oral histology practicum session, students are able to identify the microscopic structures of the orocraniofacial tissues including dental hard tissues and their supporting tissues and able to relate the microscopic structure to the function of the stomatognathic system. The evaluation was routinely conducted at the end of the semester. During evaluation in 2019-2020, it was revealed that a third of students perceived oral histology as difficult and did not feel confident with their understanding of oral histology. The learning strategy at that time was in campus or online practicum using histological slides to identify the microscopic structures of the orocraniofacial tissues. The implementation of innovative learning strategies was intended to increase students' understanding of oral histology and improved the learning experiences.

Serious Games
A Serious Games called HistoRM was developed with the Unity game platform and was

integrated into the SCORM activity in the Universitas Indonesia moodle-based learning management system (EMAS). This educational puzzle-based game consisted of four gameplays: (1) jigsaw puzzle; (2) find the differences; (3) match the pictures; and (4) crosswords. The two topics of oral histology learning subjects that were used in HistoRM games were: (1) the histology of oral mucosa, and (2) the histology of the tooth and its supporting structure. Each topic was divided into three stage levels, and each stage contained five missions, a total of 15 missions for each topic. The mission can be divided into two sessions (puzzle game session and quiz session). Students were required to clear the puzzle game session first before continuing to the quiz session and were able to repeat the mission multiple times if they want to relearn the subject matter. One-to-three-star points can be collected in every mission, depending on the winning condition such as the time to complete the mission, the number of mistakes, and the number of hint-feature used. These star points were collected and determined the player ranking in comparison to other players and were monitored in a leaderboard ranking system. There was no time limit for playing HistoRM games.

We incorporated fun elements into the HistoRM games which included custom-made avatars that represented the players, custom-made backgrounds and music. Players can design the avatars (hairstyle, hair colour, clothes and other accessories) (Figure 2F-G). The facial expression of the avatars changes based on the process when they played the games. A character known as Molara, a human-tooth-form creature, was developed and served to guide the students. In the beginning, Molara gave an explanation of the learning outcomes of each stage, gave instructions on how to play the puzzle-based games or offered the hint feature when the players had difficulties completing the mission. At the end of the quiz session, Molara provided immediate feedback and explanation related to the quiz topics.

Assessments
Pre-test was carried out to determine students' prior knowledge before the intervention. The impact of HistoRM as complementary learning was assessed with post-tests. Post-tests were given on day 3, to compare student's cognitive skills in HistoRM group with the practicum handouts (script-based) group, while post-test was carried out on day 7 to assess students' cognitive skills between the groups tested which have been given both interventions in a different order. Pre- and post-test consisted of 30 multiple-choice questions that were shuffled between and within questions and were carried out in EMAS.

Questionnaire
The questionnaire consists of 21 questions of which 14 questions were answered by a 4-point Likert scale. Questions were divided into general information (7) and 3 domains consisted of learning content domain (3), game aspect domain (5), and learning experience domain (6). The validity and reliability of the questionnaire were tested using face validity, Cronbach alpha, and the ICC test. A face validity test was carried out on 12 students (1 male and 11 females).

Intervention Type
Other

Primary outcome(s)
Students' prior knowledge and cognitive skills measured using pre- and post-testing with 30 multiple-choice questions, available in the Universitas Indonesia moodle-based learning management system (EMAS). Pre-test was conducted prior to the trial while post-tests were conducted on days 3 and 7 following the interventions

Key secondary outcome(s)

Student perception of HistoRM games measured using a questionnaire consisting of 21 questions divided into general information (7), learning content domain (3), game aspect domain (5), and learning experience domain (6) at one timepoint following topic 2 day-7 post-test

Completion date
26/12/2022

Eligibility

Key inclusion criteria
1. Undergraduate first-year dental students studying the basic oral biology practicum course in the first semester of the dental curriculum of the 2022/2023 academic year
2. Third-year dental students were involved in the recruitment of study participants and their participation in this study was voluntary
3. All respondents filled out the informed consent

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Adult

Sex
All

Total final enrolment
106

Key exclusion criteria
Students who did not complete the mission of the HistoRM Games

Date of first enrolment
01/11/2022

Date of final enrolment
01/12/2022

Locations

Countries of recruitment
Indonesia

Study participating centre
Universitas Indonesia
Faculty of Dentistry

Jl. Salemba Raya No. 4 Jakarta Pusat
Jakarta
Indonesia
10430

Sponsor information

Organisation
Universitas Indonesia

Funder(s)

Funder type
University/education

Funder Name
Universitas Indonesia

Alternative Name(s)
University of Indonesia, UI

Funding Body Type
Government organisation

Funding Body Subtype
Universities (academic only)

Location
Indonesia

Results and Publications

Individual participant data (IPD) sharing plan
Datasets generated during and/or analysed during the current study are/will be available upon request from Dr Lisa Amir (lisa.amir@ui.ac.id, lisa.amir@gmail.com)

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		23/08/2023	08/04/2024	Yes	No

Other publications	30/08/2024	01/04/2026	Yes	No
Study website	11/11/2025	11/11/2025	No	Yes