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Effect of WebQuest-based education on critical thinking and academic self-efficacy of midwifery students: Study protocol of a randomized, controlled crossover trial

Azam Mohammadi¹, Maryam Modarres², Zohreh Khakbazan², Akram Sadat Sadat Hoseini³, Mohammad Asghari-Jafarabadi^{4,5,6}, Mehrnaz Geranmayeh²

¹Nursing and Midwifery Care Research Center, Department of Midwifery and Reproductive Health, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran, ²Department of Reproductive Health and Midwifery, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran, ³Department of Pediatric and NICU, School of Nursing and Midwifery, and a Member of Research Center of Hadith, Quran and Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran, ⁴Cabrini Research, Cabrini Health, VIC, Australia, ⁵School of Public Health and Preventative Medicine, Faculty of Medicine, Nursing and Health Sciences, Monash University, VIC, Australia, ⁶Road Traffic Injury Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

Address for correspondence:

Dr. Mehrnaz Geranmayeh, Tehran University of Medical Sciences, Dr Mirkhani (Eastern Nosrat) Street, Tohid Square, Post Code: 1419733171, Tehran, Iran. E-mail: Geranmay@tums.ac.ir

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Abstract:

BACKGROUND AND AIM: Critical thinking fills the gap between theoretical and clinical teaching and increases the power of clinical decision-making. WebQuest is an innovative, learner-centered, and effort-driven learning approach that uses computer technology to engage and motivate learners. In WebQuest, learners are compelled to use the latest information available on the web as a tool to promote higher levels of thinking. However, we did not find a study that used WebQuest to improve students' critical thinking and academic self-efficacy. The aim of this study will be to investigate the effect of WebQuest-based education on the critical thinking of midwifery students.

MATERIALS AND METHODS: This superiority randomized, controlled crossover trial will be carried out among fifth-semester undergraduate midwifery students. Participants will be allocated to one of two event groups (A and B) using block randomization. In the first sequence (FS) (four weeks) of study, both groups will simultaneously attend two different education groups (WebQuest and traditional). During the FS, WebQuest will be used to teach group A participants, while group B participants will be treated as the control group (CG) and be taught using a traditional presentation. In the second sequence (SS), the interventions will be crossed over. Participants in both groups will complete the sociodemographic questionnaire, the California Critical Thinking Skills Test (CCTST), the California Critical Thinking Disposition Inventory (CCTDI), and the Academic Self-Efficacy Beliefs Questionnaire (ASEBQ) once before the first sequence of the study, during the washout period, and at the end of the second sequence of the study. The teaching satisfaction questionnaire will be completed at the end of the study.

DISCUSSION: The results of this study can be used as a basis for teaching midwifery students using WebQuest as a new teaching method.

Keywords:

Academic self-efficacy, critical thinking, education, midwifery, traditional, WebQuest

Introduction

Critical thinking is a cognitive approach^[1] and a non-linear process in which the context and criteria of an issue are considered together.^[2] There is a good

relationship between critical thinking and academic success. This type of thinking has been a global goal in colleges and higher education institutions.^[3,4] The World Federation of Medical Education considers this type of thinking as a global standard of

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medical education and obliges universities to teach their students on how to deal with issues in a critical way.^[5]

Today, in professions related to the medical sciences, caregivers face complex issues and problems that require critical thinking to make decisions. This is because critical thinking increases the power of clinical decision-making in medical care. This type of thinking fills the gap between theoretical and clinical teaching and will always play a key role in health care,^[6] midwifery, and nursing.^[7] In order to use specialized skills, midwives need advanced cognitive skills to be able to apply critical thinking in their decisions with intellectual independence.^[8,9]

Various methods have been developed for the effective use of the internet in educational activities, one of which is WebQuest.^[10] WebQuest is a new educational method with a constructivist learning theory approach.^[11] According to the constructivist approach, the learner needs to carefully explore potential issues or problems, ask questions, review prior knowledge, and offer a strategy for intervention.^[12] WebQuest as an educational method facilitates and enhances high-level cognitive skills such as critical thinking, search, and problem-solving. WebQuest engages learners in collaborative learning and group projects based on the idea of search and research and constructivist theory.^[13] It emphasizes the importance of combining tasks with reputable online references to strengthen critical thinking skills. Through WebQuest, learners are compelled to use the latest information available on the web as a tool to promote higher levels of thinking, such as critical thinking, decision-making, and prioritization through analysis, synthesis, and evaluation.^[14]

Academic self-efficacy has been proven to be a powerful predictor when critical performance is as global as the self-efficacy level measured.^[15] Honicke and Broadbent^[16] showed that educational strategies that led to in-depth processing and goal orientation could improve academic self-efficacy and performance. Also, different studies have shown the effect of education on improving students' self-efficacy,^[17,18] while the effect of computer- and internet-based educational methods such as WebQuest on self-efficacy has not been paid much attention.

Although there is agreement on the value and importance of integrating strategies that foster critical thinking into undergraduate midwifery courses, there is little understanding of the best approaches to developing these skills.^[9,19] The inadequacy of the traditional discourse method to promote critical thinking is well documented.^[20,21] Also, the use of simple methods based on computers and the internet has not always been effective.^[22]

Therefore, considering that one of the goals of midwifery training programs should be to teach students critical thinking and prepare them for clinical practice^[8,9] and since, according to the review of available literature, a study that examined the effect of educational WebQuest on midwifery students' critical thinking could not be found, the researchers decided to conduct an interventional study aimed at examining the effect of WebQuest-based education on the level of critical thinking and academic self-efficacy of midwifery students.

Materials and Methods

Study design and setting

The present study is a superiority randomized, controlled crossover trial. Randomized, controlled crossover studies are types of randomized trials that have been used in many studies, including studies involving student education in different groups of medical sciences.^[23,24] The use of a crossover design allows the differences between the two groups to be examined in a controlled manner. Additionally, participants in a crossover trial can express their preferences by comparing their experiences of the two interventions, which is not possible in a parallel group design because participants receive only one intervention.^[25] The overview of the study is presented in Figure 1.

This study will be performed in the School of Nursing and Midwifery at the Tehran University of Medical Sciences, Iran. The School of Nursing and Midwifery is the top school in the field of midwifery in Iran. Every year, several students from all over Iran enter the School of Midwifery and Nursing after passing the national certification exam, called the university entrance exam. This study will include the participation of midwifery students and professors of pregnancy and childbirth courses at the School of Nursing and Midwifery.

Eligibility criteria

Inclusion criteria for participating in the study will be those studying midwifery in the School of Nursing and Midwifery, Tehran University of Medical Sciences and those with no previous history of receiving the course for reasons such as failing the course. Exclusion criteria will be an unwillingness to continue the class and being a guest student from another university. Criteria for discontinuing the study will be becoming a guest to another university and electing not to continue participation.

Interventions

We will receive the numbered list of students for the relevant course (Pregnancy and Childbirth [fifth semester undergraduate midwifery students]) from the

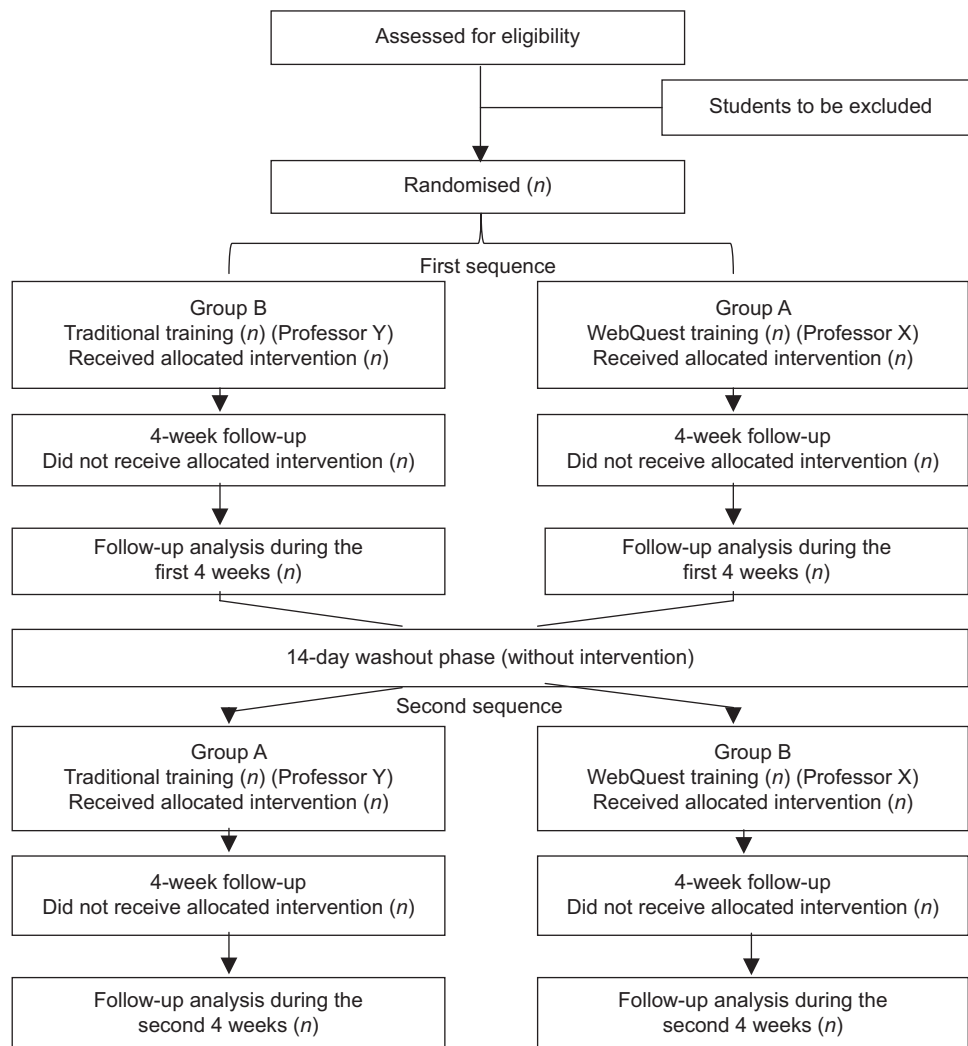


Figure 1: Overview of the study

faculty education office. The content of the pregnancy and childbirth course includes full knowledge of abnormal cases in childbirth and performing some abnormal births. Pregnancy and childbirth courses are among the two-unit courses approved by the Iranian midwifery students' educational program, which are taught at the Tehran University of Medical Sciences by two independent instructors with the same educational background. During this research, one unit of this course (eight sessions) will be used as intervention and the remaining unit of the course continue as traditional approach.

Half of the course (four sessions or half unit) will be done as traditional approach to teaching (lecture method), and the other half (four sessions or half unit) will be done based on the WebQuest method. The choice of teaching topic for each method will be randomly selected. Attendance at the meetings will be recorded to assess the adherence to the intervention. Also, participating students will be asked not to participate in the workshop

or class related to pregnancy and childbirth during the study.

In order to conduct the study, first the students assigned to group A will be taught on pregnancy and childbirth by WebQuest by the researcher (course teacher), respectively. The students in group A will be divided into small groups of four to five people. In order to comply with all parts of this educational approach, all six parts (introduction, task, process, resource, evaluation/assessment, and conclusion) will be carefully designed and implemented [Table 1]. The first part will be the introduction in which a brief explanation of the relevant topic will be given and the objectives of the topic will be presented. In the task part, the task intended for students will be clearly described and approved sources will be introduced for review. A set of information sources is needed to complete the task described for students. Information sources include web documents, experts or instructors available via e-mail or a WhatsApp group, searchable databases on the net, and books and other

documents physically available in the student's library. Because pointers to resources are included, the learner is not left to wander through the web space completely adrift. Then, in the guidance part, what is expected of the student to prepare at the end, along with the instructions for its preparation and a small amount of content, will be explained. In the conclusion part, the findings of each group are first discussed within the group, and the instructor will be responsible for leading the discussions. (For each group, a WhatsApp group will be formed with the participation of members of the same group, and the relevant professor will be in that group and will be responsible for leading the students' discussions at their discretion during the work) The student will be informed about the evaluation method from the first session, and the sub-scores considered for each part will be determined by the research

team [Table 2]. Then, one of the group members who is in charge of the group will present the findings with the cooperation of the other members of the group. It should be noted that doing each topic and reviewing the various dimensions considered will take a week.

Simultaneously with the students of group A, the students assigned to group B will also receive other topics in the traditional way from the relevant professor (another instructor). At the end of the first sequence of the intervention, individuals will re-complete the California Critical Thinking Skills Test (CCTST), the California Critical Thinking Disposition Inventory (CCTDI) and the Academic Self-Efficacy Beliefs Questionnaire (ASEBQ). After a two-week period (according to the design of crossover trials after the first intervention period), a non-intervention period is considered the washout

Table 1: Parts of conducting pregnancy and childbirth training using WebQuest method for midwifery students

| Part | Action |
|-------------------------|--|
| 1 Introduction | A brief presentation on the background and importance of the problem to be considered in the next session. |
| 2 Task | The student will be required to draw a concept map for each topic, including problem pathophysiology, signs and symptoms of disease, prevention, differential diagnosis, treatment, and care required, and then review their concept map with other group members and reach and present a single concept map. In this part, for each disease and problem, two internal sources (book or other information source) and an English source are given for the student to search the internet and obtain the necessary information. |
| 3 Process | Students will be taught how to draw a concept map in a virtual training session. Students will also be helped by one of the authors (AM) to map out the concepts, and the groups will be led by the instructor to do the homework in WhatsApp groups. |
| 4 Resource | Information sources include web documents, experts, or instructors available (via email or WhatsApp group), searchable databases on the internet, and books and other documents physically available in the student's library. Because pointers to resources are included, the learner is not left to wander through web space completely adrift. Resources used for each topic will be given to students. |
| 5 Evaluation/assessment | In this part, students draw a concept map for each problem in the form of an A3 sheet and within a week in their group. The evaluation method is described in the <i>Evaluation Table of Students' Work and Efforts in Each Group</i> . |
| 6 Conclusion | Conclusion of each topic by each group. |

Table 2: Evaluation table of students' work and efforts in each group

| | Excellent | Good | Fair | Weak | Score |
|---|---|---|--|--|------------------------|
| Review the internet references provided and take advantage of more references | Used the available references correctly and used more references to better understand the subject | Used the available references correctly and obtained relevant content | Reviewed 2 or more references to obtain relevant content | Only reviewed one reference or plagiarized content | 20% of the total score |
| Answer questions during the presentation | Expressed the content correctly and answered the questions with a correct understanding of the content | Presented the content correctly but did not gain a full understanding of the content and its relevance | Answered questions briefly and incompletely and reached an incomplete understanding of the content | Was unable to answer questions and had no understanding of the content | 20% of the total score |
| Participation and leadership in the group | Had effective collaboration with other members, had a positive impact on other members of the group, and could lead the group | Collaborated with other members and was well aware of what was being presented and was not influenced by the misinformation of others | Tried to work with the group, but was impressed by the weak students | Did not participate in the activities of the group and the content was plagiarized | 20% of the total score |
| Content provided | Absolutely correct content and logical routine | Correct content but without following a logical procedure to understand the content | The content was somewhat accurate and did not follow a logical procedure for understanding the content | False or plagiarized content | 30% of the total score |
| Time management | All aspects and content were presented in the allotted time. | Most (but not all) aspects were presented in the allotted time. | Only some aspects were mentioned in the allotted time. | -- | 10% of the total score |

Total score=100%

period.^[26] In this study, these two weeks will be considered the period of washout (non-intervention (and the time required to complete the post-test questionnaires (first sequence of the study)). The people of the two groups will be moved in terms of the intervention received, and the people of group B will be placed in the intervention group by the WebQuest method, and the work process will be considered as before for the discussions of this group. It should be noted that in order to reduce the bias caused by the instructor after the transfer of students in the type of education, the professor who had presented topics for the first group in the traditional method will present the same topics for the new group in the traditional method. The professor who presented the topics for the previous group in the WebQuest method will present the same topics in the same method to the new group. In fact, students will receive half of the topics in the traditional method by one professor and half in the WebQuest method by another professor. At the end of the training sessions, the CCTST, CCTDI, ASEBQ, and the Teaching Satisfaction Questionnaire will be completed for both groups. Since each participant is actually used as their control and paired tests will also be used in the results, and as the selection of individuals in groups will be done randomly, intervention variables will be controlled.

Outcomes

The primary outcomes of this study will be including 3 variables; critical thinking skills, critical thinking disposition, and academic self-efficacy beliefs score. Critical thinking skills and disposition and academic self-efficacy beliefs will be recorded before the intervention, after the first sequence, and at the end of the second sequence. The Teaching Satisfaction Questionnaire will be assessed after the second sequence as a secondary outcome.

Study participant and sampling

The study will be conducted for 10 educational weeks, which will start at the end of February 2022 and continue until about May 2022. In Iran, each semester lasts about 16 weeks and this period is divided into two sequences of eight weeks. This article is reported according to the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) statement.^[27] A SPIRIT diagram detailing the timing of enrollment, interventions, and assessments is provided in Figure 2. A completed SPIRIT checklist is also provided in Additional File 1.

About 30 to 40 students are admitted to Tehran University of Medical Sciences every year. Due to the fact that the present study will be performed on fifth semester students of this faculty, the sample size for each arm in each sequence of the study will be at least 15 students.

Sequence generation

Target-based sampling and allocation in WebQuest educational intervention and control groups are random and will be numbered in the initial list with a 1:1 allocation ratio in blocks of four and six, respectively.

Allocation concealment mechanism

Sequentially numbered, opaque, and sealed envelopes of the same shape and size containing the group's name will be used to conceal the allocation and to maintain blinding with no label on it. In this way, group A students will be allocated to the WebQuest training group and group B students will be allocated to the control group.

Implementation

The sequencing of allocation and preparation of envelopes will be done by a person not involved in sampling and data collection. The envelopes will be opened in the presence of the participant and out of sight

Figure 2: SPIRIT flow diagram of study procedures

| | Enrollment | Allocation | Study period | | | | |
|--|------------|------------|-----------------|----|----|-----|----------------|
| | | | Post-allocation | | | | Close-out |
| Timepoint | -1w | 0 | W1 | W4 | W6 | W10 | End of Week 10 |
| Enrollment: | | | | | | | |
| Eligibility screen | X | | | | | | |
| Informed consent | X | | | | | | |
| Allocation | | X | | | | | |
| Interventions: | | | | | | | |
| [First sequence duration (WebQuest or control)] | | | | | | | |
| [Washout period] | | | | | | | |
| [Second sequence duration (WebQuest or control)] | | | | | | | |
| Assessments: | | | | | | | |
| [Demographic and academic characteristics] | | X | | | | | |
| [Critical thinking disposition & critical thinking skills] | | | X | | X | | X |
| [Academic self-efficacy] | | | X | | X | | X |
| [Satisfaction of teaching] | | | | | | | X |

of the other participants, and the group of the individual will be determined at this time.

Blinding

The researcher involved in the sampling and the participants will not know what group the person will be in until the study begins. Therefore, the investigators and participants will be unaware of the group name for every participant until the beginning of the first sequence of interventions.

Data collection methods

Prior to the intervention, both groups will complete the sociodemographic questionnaire, the California Critical Thinking Skills Test (CCTST), the California Critical Thinking Disposition Inventory (CCTDI), the Academic Self-Efficacy Beliefs Questionnaire (ASEBQ) and Shakour's Teaching Satisfaction Questionnaire.

Demographic and academic questionnaire

This questionnaire consists of two parts, namely, the demographic and educational characteristics of the student, which will be completed at the beginning of the study. The demographic section includes eight questions about age, marital status, employment, place of birth, current residence, economic status, and history of other stressful events during the last six months. The educational characteristics section includes the number of semesters spent, having a history of dismissal or probation and interest in the field.

Ricketts's Critical Thinking Disposition Inventory

In 2003, Ricketts summarized the California Critical Thinking Disposition Inventory (CCTDI) in a more concise, accurate, and coherent manner. This questionnaire is a self-assessment tool that has 33 items under three components, namely, innovation and creativity (11 items), perfection or maturity (9 items), and mental engagement or commitment (13 items). Items relating to creativity/innovation include 1, 5, 7, 11, 14, 17, 24, 25, 26, 28, and 29, to perfection include 2, 12, 15, 19, 21, 23, 30, 32, and 33, and to mental engagement include 3, 4, 6, 8, 9, 10, 13, 16, 18, 20, 22, 27, and 31. This questionnaire is also known as Engagement, Maturity, and Innovativeness (EMI) assessment. Participants, on a five-point Likert scale from strongly disagreeing (1) to strongly agreeing (5), determine how much they disagree or agree with each of the statements. In this questionnaire, the scoring is as follows: strongly disagree = 1, disagree = 2, not sure = 3, agree = 4, strongly agree = 5. Questions 2, 12, 15, 19, 23, 30, 32, and 33 are scored in reverse. The maximum and minimum scores obtained in this test are 165 and 33, and the average is 99. The creativity subscale has a maximum of 55 and a minimum of 11 with an average of 33; the subscale of maturity has a maximum score of 45 and a minimum

of 9 with an average of 27; and the subscale of mental engagement has a maximum score of 65 and a minimum of 13 with an average score of 39.^[28]

California Critical Thinking Skills Test (CCTST)

The CCTST includes 34 questions in 5 subscales of critical thinking skills, namely, analysis, evaluation, inference, inductive reasoning, and deductive reasoning. One of each question's four or five different options is correct. For each correct option, a score of one is given to the subject, and no score is given for incorrect answers or non-answers; thus, the minimum score on this test is zero and the maximum is 34. Sometimes, scores of subscales are expressed in percentages for ease of reporting results and tangibility. The CCTST, Form B, has been standardized in various countries and has been found to have good validity and reliability. This test has been adjusted according to the cultural conditions of our country, and the formal and content validity of the test have been approved.^[29] Furthermore, the reliability of the test was studied in the study by Hasanpour *et al.*^[30] on Iranian nursing students and was confirmed by 83% Cronbach's alpha.

Academic Self-Efficacy Beliefs Questionnaire (ASEBQ)

This questionnaire consists of four factors to measure students' self-efficacy beliefs: (1) confidence in academic performance in class; (2) confidence in academic performance outside of class; (3) confidence in interaction at school, and (4) confidence in ability to manage work, family, and university. This scale contains a list of 27 tasks such as "asking questions in class" and "managing both school and work". For each task, students are asked to rate on an 11-point Likert scale on how confident they are that they could successfully complete them (from 0 = not at all confident to 10 = extremely confident). Higher scores indicate higher academic self-efficacy.^[31] The validity and reliability of this questionnaire has been confirmed by Shokri *et al.*^[32] They showed that Cronbach's alpha coefficients of the multidimensional factors of ASEBQ were acceptable.

Teaching Satisfaction Questionnaire

In this study, to measure students' teaching satisfaction, Shakour *et al.*'s^[33] Satisfaction Questionnaire will be used, which includes items on willingness to attend class, the amount of learning in relation to the topic presented, the consistency of learning, the willingness to use the WebQuest method in other classes, the willingness to participate in such classes, and their waste of time. The scale of the satisfaction questionnaire, depending on the type of questions, is classified as "excellent", "good", and "average", "low", or "yes", "somewhat", and "no". In a study by Haghani *et al.*,^[34] Cronbach's alpha (=0.68) was used to confirm formal and content validity and reliability.

Data management

Participating students will be assured that their answers will be kept completely secure and there will be no right or wrong answers. The collected data will be collected by the corresponding author (AM) and entered into the data analysis software. The first author (MG) will randomly review several data sets to ensure the accuracy of the data entered.

Statistical methods

The author responsible for data analysis will be blind to the allocation sequence of the students, and the file related to the collected data will be named in A and B without specifying the group of individuals. Data will be analyzed and carried out using IBM SPSS Statistics version 22.0 (IBM, Chicago IL., USA). The normality of quantitative data will be examined by measuring skewness and kurtosis. Descriptive statistics such as mean, standard deviation, and frequency will be used to describe individual social variables. Analysis of covariance (ANCOVA) and *t* test (independent) will be used to compare the two groups before and after the intervention and paired *t* test will be used to compare before and after each group (within-group comparison). If necessary, non-parametric test will be used for analysis. *P* value of less than 0.05 will be considered statistically significant.

Data monitoring

The research ethics committee is responsible for supervising the conduct of this study. This committee is independent of the sponsor and any competing interests in this study.

Harms

In order to identify the unwanted effects caused by the implementation of this study, all the participating students will complete the teaching satisfaction questionnaire in order to determine and identify the unwanted effects of the interventions.

Ethical consideration

This proposed study has the approval by the Ethics Committee in Biological Research from the Vice Chancellor for Research and Technology of Tehran University of Medical Sciences (code: IR.TUMS.FNM.REC.1400.029).

Protocol amendments

Any methodological changes in the study design or sample size, which may potentially affect the participants' safety or study procedures, will be discussed in the ethics committee in biological research of ethics before the study initiation.

Consent or assent

To conduct the study, the corresponding author (MG) will be present in the pregnancy and childbirth class

and will provide the necessary information about the study to the students and will offer them the opportunity to participate in the study. Then, referring to the voluntary participation in the study and the fact that the participant is allowed to leave this research at any time without giving any reason, we will receive written informed consent from the qualified people who want to participate in the study.

Confidentiality

All data will be identified by a student number to maintain the participants' confidentiality.

Discussion

This crossover interventional study will show whether WebQuest training is effective on students' levels of academic self-efficacy and cognitive ability, including their critical thinking (skills and disposition). The main aim of this study is the skill and disposition to think critically in students, and the secondary purpose of the study is to determine the possible impact of WebQuest-based education on students' levels of academic self-efficacy. Extensive changes are taking place in the field of health and clinical services every day, and the curriculum in each profession must have the necessary flexibility to deal with these changes. Certainly, the traditional curriculum does not meet the professional needs of clinical occupations such as nursing, medicine, and midwifery in today's world.^[35,36] Given the positive relationship between the curriculum and the tendency for critical thinking and the inadequacy of the curriculum and traditional teaching methods to promote this type of thinking in students, it is necessary to revise the curriculum and its elements, especially in the area of teaching/learning methods. The curriculum should be organized in a way that teaches learners how to judge and think about their own lives.

Teaching by WebQuest method using the skills of: problem identification, group activity, comprehensive thinking on the subject, analysis of available resources and available to students, team work, asking questions to group members and the instructor, interacting and communicating with group members, and gathering information from up-to-date sources can improve critical thinking standards, which is one of the strengths of our study. The crossover design of this study is another strength because it means that controlling each group compared to that group itself will greatly control the impact of possible interfering factors. On the other hand, the lack of a similar study is another strength of the present study, which shows the innovation of the present study. Due to time constraints, it is not possible to measure the effects of this type of education on the level of critical thinking of students in clinical practice

and internships, but it is recommended to conduct longitudinal studies to measure the effects of WebQuest training on thinking levels.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/ have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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The study was registered on Iranian Pajoheshyar, research Management system (research.tums.ac.ir) with trial registration number code 52951.

Conflicts of interest

There are no conflicts of interest.

References

- Victor-Chmil J. Critical thinking versus clinical reasoning versus clinical judgment: Differential diagnosis. *Nurse Educ* 2013;38:34-6.
- Akhoundzadeh K, Hosseini A, Salehi Sh. *Critical Thinking and Clinical Decision Making in Nursing*. 1st ed. Isfahan: Isfahan University of Medical Science; 2006.
- Peeters MJ, Zitko KL, Schmude KA. Development of critical thinking in pharmacy education. *Innov Pharm* 2016;7:1-9. doi: 10.24926/iip.v7i1.415.
- Ross D, Loeffler K, Schipper S, Vandermeer B, Allan GM. Do scores on three commonly used measures of critical thinking correlate with academic success of health professions trainees? A systematic review and meta-analysis. *Acad Med* 2013;88:724-34.
- World Federation for Medical Education. *Basic Medical Education, WFME Global Standards for Quality Improvement*. Denmark: WFME office: University of Copenhagen; 2003.
- Paul SA. Assessment of critical thinking: A Delphi study. *Nurse Educ Today* 2014;34:1357-60.
- Sarhangi F, Masoumy M, Ebadi A, Seyyed Mazhari M, Rahmani A, Raisifar A. Effect of concept mapping teaching method on critical thinking skills of nursing students. *Iran J Crit Care Nurs* 2011;3:143-8.
- Carter AG, Creedy DK, Sidebotham M. Measuring critical thinking in pre-registration midwifery students: A multi-method approach. *Nurse Educ Today* 2018;61:169-74.
- Carter AG, Creedy DK, Sidebotham M. Efficacy of teaching methods used to develop critical thinking in nursing and midwifery undergraduate students: A systematic review of the literature. *Nurse Educ Today* 2016;40:209-18.
- Dodge B. Some Thoughts About WebQuests. 1997. Available from: http://webquest.org/sdsu/about_webquests.html. [Last accessed on 2021 Jan 01].
- Jahromi ZB, Mosalanejad L. Integrated method of teaching in Web quest activity and its impact on undergraduate students' cognition and learning behaviors: A future trend in medical education. *Glob J Health Sci* 2015;7:249-59.
- Bada SO, Olusegun S. Constructivism learning theory: A paradigm for teaching and learning. *J Res Method Educ* 2015;5:66-70.
- Yang C-H, Tzuo PW, Komara C. Using WebQuest as a Universal Design for Learning tool to enhance teaching and learning in teacher preparation programs. *J Coll Teach Learn (TLC)* 2011;8:21-30. doi: 10.19030/tlc.v8i3.4121.
- Chen C. Effects of the application of WebQuest to technology education on business management students' critical thinking psychology and operation capability. *Contemp Educ Technol* 2020;13:1-8.
- Grøtan K, Sund ER, Bjerkeset O. Mental health, academic self-efficacy and study progress among college students-The SHoT study, Norway. *Front Psychol* 2019;10:45.
- Honick T, Broadbent J. The influence of academic self-efficacy on academic performance: A systematic review. *Educ Res Rev* 2016;17:63-84.
- Tiyuri A, Saberi B, Miri M, Shahrestanaki E, Bayat BB, Salehiniya H. Research self-efficacy and its relationship with academic performance in postgraduate students of Tehran University of Medical Sciences in 2016. *J Educ Health Promot* 2018;7:11.
- Hajhashemi M, Mazaheri MA, Hasanazadeh A. Assessment of educational intervention in enhancing parenting self-efficacy in parents of primary school students. *J Educ Health Promot* 2019;8:43.
- Tiwari A, Lai P, So M, Yuen K. A comparison of the effects of problem-based learning and lecturing on the development of students' critical thinking. *Med Educ* 2006;40:547-54.
- Banfield V, Fagan B, Janes C. Charting a new course in knowledge: Creating life-long critical care thinkers. *Dynamics (Pembroke, Ont)* 2012;23:24-8.
- Popil I. Promotion of critical thinking by using case studies as teaching method. *Nurse Educ Today* 2011;31:204-7.
- Kordi M, Fakari FR, Mazloum SR, Khadivzadeh T, Akhlaghi F, Tara M. Comparison of the effect of web-based, simulation-based, and conventional training on the accuracy of visual estimation of postpartum hemorrhage volume on midwifery students: A randomized clinical trial. *J Educ Health Promot* 2016;5:22.
- Alharbi F, Alazmi KF, El Momani BR, Al-Muzian L, Wertheimer M, Almkhtar A, *et al.* Phone-based audience response system as an adjunct in orthodontic teaching of undergraduate dental students: A crossover randomised controlled trial. *BMC Med Educ* 2020;20:435.
- Dhaliwal HK, Allen M, Kang J, Bates C, Hodge T. The effect of using an audience response system on learning, motivation and information retention in the orthodontic teaching of undergraduate dental students: A cross-over trial. *J Orthod* 2015;42:123-35.
- Dwan K, Li T, Altman DG, Elbourne D. CONSORT 2010 statement: Extension to randomised crossover trials. *BMJ* 2019;366:l4378.
- Sibbald B, Roberts C. Understanding controlled trials. Crossover trials. *BMJ* 1998;316:1719.
- Chan A-W, Tetzlaff JM, Gøtzsche PC, Altman DG, Mann H, Berlin JA, *et al.* SPIRIT 2013 explanation and elaboration: Guidance for protocols of clinical trials. *BMJ* 2013;346:e7586.
- Amin Khandaghi M, Pakmehr H. Critical thinking disposition: A neglected loop of humanities curriculum in higher education. *Cypriot J Educ Sci* 2012;7:1-13.
- Khoda Modardi K, Saeid AM, Alavi MH, Yaghmaei F, Shahabi M. Translation and psychometric properties of California critical thinking skills test (form B). *Adv Nurs Midwifery (Faculty of Nursing of Midwifery Quarterly)* 2007;16:12-19.
- Hasanpour M, Hasanazadeh A, Ghaedi Heidari F, Bagheri M. Critical thinking skills of nursing students. *Iran J Nurs* 2015;28:22-31.

31. Zajacova A, Lynch SM, Espenshade TJ. Self-efficacy, stress, and academic success in college. *Res High Educ* 2005;46:677-706.
32. Shokri O, Toulabi S, Ghanaei Z, Taghvaeinia A, Kakabaraei K, Fouladvand K. A psychometric study of the academic self-efficacy beliefs questionnaire. *Studies in Learning and Instruction* 2012;3:11-16.
33. Shakour M, Haghani F, Shokri T, Bahramian H. The effect of game method on students' satisfaction and achievement in anatomy course. *J Isfahan Med Sch* 2013;31:1038-47.
34. Haghani F, Bakhtiari S, Ghaedi Heidari F. Effect of game based teaching on satisfaction and learning of midwifery students in social psychology course. *Educ Ethics Nurs* 2018;7:375-82.
35. Bellack JP, Graber D, O'Neil EH, Musham C. Curriculum trends in nurse-midwifery education: views of program directors. *J Nurse Midwifery* 1998;43:341-50.
36. Rowan C, McCourt C, Beake S. Midwives' reflections on their educational programme: A traditional or problem-based learning approach? *Midwifery* 2009;25:213-22.