

A Novel Approach to Teach Evidence-Based Medicine: Modified PEARLS

Kanıt Dayalı Tıp Öğretiminde Yeni Bir Yöntem: Modifiye PEARLS

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ABSTRACT

Objective: We aimed to present our two years of evidence-based medicine training experience and evaluate the effectiveness of a modified PEARLS by analyzing feedback obtained from fourth-year medical students and their advisors (faculty members).

Methods: This study was conducted with fourth-year students and advisors in 2018 (346 students and 54 advisors) and 2019 (355 students and 59 advisors) at Gazi University Faculty of Medicine. PEARLS, which is an acronym for "Presentations of Evidence Abstracted from Research Literature to Solve real people's problems", is a method teach evidence-based medicine. A modified PEARLS method was used for teaching not only evidence-based medicine but also group work, preparing a presentation, public speaking, and reflective thinking. Students were divided into groups and provided a case for each student. Groups met with advisors six times for group discussions. Students presented their decision process orally to their peers and advisors. Oral presentations were recorded as a video to enable students to reflect on them later.

Results: Students' scores were significantly lower than advisors' scores for the item which is about keeping up the program. Except for this item, advisors' scores were lower than students' scores for all items. The timing of the program was the most complained part by the students. For advisors, the difficulty of arranging appropriate time was the most complained part.

Conclusions: Using modified PEARLS to integrate evidence-based practices with preparing a presentation, public speaking, and reflective thinking is a novel approach. To systematically put them together, the modified PEARLS method would be a useful option.

Keywords: medical education; evidence-based medicine; public speaking; reflection

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ÖZET

Amaç: Bu çalışmada, iki yıllık kanıt dayalı tıp eğitimi deneyimimizi sunmayı ve dördüncü sınıf tıp öğrencileri ve danışmanlarından (öğretim üyeleri) elde edilen geri bildirimleri analiz ederek modifiye PEARLS yönteminin etkililiğini değerlendirmeyi amaçladık.

Yöntem: Bu çalışma Gazi Üniversitesi Tıp Fakültesi'nde 2018 (346 öğrenci ve 54 danışman) ve 2019 (355 öğrenci ve 59 danışman) yılında dördüncü sınıf öğrencileri ve danışmanlar ile gerçekleştirilmiştir. "Gerçek insanların problemlerini çözmek için literatürden elde edilen kanıtların sunumu" ifadesinin kısaltması olan PEARLS, kanıt dayalı tıbbi öğretmek için kullanılan bir yöntemdir. Bu çalışmada yalnızca kanıt dayalı tıbbin öğretimi için değil, aynı zamanda grup çalışması, sunum hazırlama, topluluk önünde konuşma ve refleksiyon becerilerini de geliştirmek için modifiye PEARLS yöntemi kullanılmıştır. Öğrenciler gruplara ayrılmış ve her öğrenci için birer vaka verilmiştir. Gruplar, grup tartışmaları için danışmanlarla altı kez bir araya gelmiştir. Öğrenciler karar süreçlerini akranlarına ve danışmanlarına sözlü olarak sunmuşlardır. Sözlü sunumlar, öğrencilerin daha sonra üzerinde düşünmelerini (refleksiyon) sağlamak için video olarak kaydedilmiştir.

Bulgular: Bu eğitimin yapılmaya devam edilmesi ile ilgili maddede öğrencilerin puanları danışmanların puanlarından anlamlı derecede düşüktür. Bu madde dışında tüm maddelerde danışmanların puanları öğrencilerin puanlarından düşük çıkmıştır. Eğitimin zamanlaması öğrenciler tarafından en çok şikayet edilen kısım olmuştur. Danışmanlar ise en çok, grup tartışmaları için uygun zamanı ayarlamamanın zorluğundan şikayet etmiştir.

Sonuç: Kanıt dayalı tıp uygulamalarını sunum hazırlama, topluluk önünde konuşma ve refleksiyon ile bütünleştirerek öğretmek için geliştirilmiş modifiye PEARLS yöntemi yeni bir yaklaşımdır. Bu becerileri sistematik olarak bir araya getirmek için modifiye PEARLS yöntemini kullanmak faydalı bir seçenek olabilir.

Anahtar Sözcükler: tıp eğitimi; kanıt dayalı tıp; topluluk önünde konuşma; refleksiyon

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INTRODUCTION

There is an exponentially growing number of studies in medicine. The estimated doubling time of medical knowledge was 3.5 years in 2010 and it is predicted to be just 73 days in 2020 (1). Therefore, the knowledge that is acquired during undergraduate years of medical school includes just a little portion of all knowledge that is newly generated (1). If physicians want to keep up with literature related to an area of clinical practice, 17 articles per day should be read throughout years (2). In order to overcome this kind of difficulties, a solution was proposed. "Evidence-Based Medicine" (EBM) term, which have deeper roots (3), was introduced by Gordon Guyatt at McMaster University in 1991 (4).

EBM can be defined as "the conscientious and judicious use of current best evidence from clinical care research in the management of individual patients" (5). In other words, it is "integration of best research evidence with clinical expertise and patient values" (6). Instead of reading all articles relevant to the field, implementation of this five steps approach might be more wisely: Converting needs of information into structured questions, searching for the best evidence to answer the questions, critically appraisal of the evidence in terms of validity and usefulness, applying the conclusion obtained from appraisal in practice, evaluating the performance (7).

There are many ways that were used for teaching EBM including didactic lectures, reading seminars, small-group discussions, workshops, one-on-one teaching, journal clubs (8,9) as well as problem-based learning (10), team learning (11), self-directed learning (12), distance learning (13), and online instructions (14). Teaching EBM basis on constructivist theory, student-centered, and based on small group activities rather than didactic instructions is more effective. Because the practice of EBM requires self-directed learning (7) and learning cannot be detached from its context as well as adult learners self-directly administer their experiential learning (15). From the perspective of teaching EBM, a study reported that small group activities are more effective than didactic instruction (16).

Our EBM program that we implemented for two years is based on constructivist theory and has different aspects from traditional methods. It has been designed not only to teach evidence-based medicine but also to enhance students' skills such as group work, preparing a presentation, public speaking, and reflective thinking. We developed and used modified PEARLS to achieve this.

PEARLS is an acronym for "Presentations of Evidence Abstracted from Research Literature to Solve real people's problems" and was developed by Stockler et al. (17) to apply EBM in clinical practice. Students apply EBM to their clinical questions that they generated from their contacts with real patients. PEARLS enables students, who had already learned the principles of EBM in their first years, to apply EBM and present the application process in a 15 minutes presentation in a structured way. Before the presentation, groups of students (each group includes 6 students) meet with their tutors 3 times to explain; what is the problem of their patients, what they have done, and what they will do until the next meeting. Students seek help from group members and tutors at meeting times. They write a one-page report that contains their reflections on the experience (17).

Although PEARLS contains many aspects of successful methods of teaching EBM (17), to our best effort, there is not any EBM program that has implemented this method to teach EBM, except the developers of PEARLS.

The purpose of this study is to present our two years of EBM training experience and evaluate the effectiveness of a modified PEARLS by analyzing feedback obtained from fourth-year medical students and their advisors (faculty members) in 2018 and 2019.

MATERIAL and METHOD*The Rationale for the Modification*

The original PEARLS necessitates students to contact real patients. Our modification was to use text-based simulated cases instead of real patients. The reason was the high number of students we have. It would be very difficult to implement the program if we use real patients.

The other change was that we used public speaking instead of a one-page report since we anticipated that public speaking would be a robust and fruitful method compared to writing a one-page report.

Structure of the Evidence-Based Medicine Program

Our institution, Gazi University Faculty of Medicine, offers a 6-year educational program and it includes the EBM program that is placed in the first four years. In the first year, medical students learn how to access websites that provide screening medical studies. In the second year, they learn the differences between the study types such as review, case presentation, and original research article. In the third year, they learn how to evaluate parts of an original research article such as introduction, material and method, results, discussion, conclusion by using a structured evaluation form.

In the fourth year, the learning objectives of our EBM program are:

- Using the ways of accessing qualified and appropriate evidence that students learned how to access them during the previous years
- Using the ways of accessing qualified and appropriate evidence that students learned how to access them during the previous years
- Developing research strategies to analyze a given case
- Synthesizing the evidence which previously was collected
- Using evidence to reach a conclusion/decision
- To present these processes as an oral presentation
- Giving feedback to group members
- Reflecting on the performance by watching video records of oral presentation

Fourth-year medical students were divided into groups which are consist of 6 or 7 students each. In total, there were 54 groups in 2018 and 59 groups in 2019 academic year. We assigned a faculty member as an advisor per group because role modeling is one of the factors that influences the effective teaching of evidence-based medicine (18). We explained the program to advisors in a one-hour presentation that also includes a question-answer session. But attendance at this informative session was not compulsory.

We provided a different case for each student. Members of the EBM Board of Gazi University Faculty of Medicine developed the cases. Cochrane and Medscape databases were used for the construction of cases. The same cases were used both in 2018 and 2019. A case example is: "Your patient is a 65 years old female with chronic low back pain. She wants to try acupuncture treatment instead of medication."

Students were responsible for reaching a conclusion/decision about the problem of the case by using evidence under the guidance of their advisors. They were also responsible for the oral presentation of this conclusion process. Group members have met their advisors a minimum of six times for 3 months. We did not allocate certain hours for the meetings, students and advisors arranged them together due to their needs and spare times. EBM program was run concurrently with other clerkship programs.

We examined PEARLS (17), which has been developed for medical students, and adapted into our program according to our needs so we provided a brief instruction that contains six steps for students:

- (1) Identify the clinical question of your case.
- (2) Develop a research strategy and use keywords.
- (3) Choose the best studies.
- (4) Evaluate the studies that you obtained.
- (5) Apply the information to the case. Reach a conclusion, make a decision.
- (6) Convert the entire process into a presentation.

To convert the given case into a clinical question, we offered a method called PICO (acronym of "Patient/Problem, Intervention, Comparison, Outcome" words) that has been developed by Richardson et al. (19). Table 1 shows an example of an application.

Table 1. An example of applying PICO framework on a case.

Patient	Intervention	Comparison	Outcome
65 years old female with chronic low back pain	Acupuncture	Medication	Reducing the pain

An example like we described here was presented a week before the distribution of cases to all students in an hour lasted presentation and question-

answer session. Also, a schedule that informs students was provided as shown in Table 2.

Table 2. Gantt chart which informs students on process.

	Distribution of cases	Selection of sources and screening studies	Identifying appropriate evidences and synthesis	Preparation of presentation	Performing oral presentation	Submission of products
March	+	+	+			
April		+	+	+		
May				+	+	+

Students' final grades were determined by their advisors right following presentations by using a structured evaluation form. The products that we have asked students to submit were presentation materials and video records which were recorded when they presented orally. Submission of video records was sourced from our desire to encourage students to watch themselves and to reflect on their performances.

Data Collection and Analysis

A form was prepared including 10 items along with a 5-point Likert scale. There were also three open-ended questions. These were "What was the best part of the program according to you?", "What should be changed?" and "Do you have any additional comments?". There were 346 students and 54 advisors in 2018, and 355 students and 59 advisors in 2019. Both students and advisors responded to the same survey which was structured according to their point of view. Students delivered feedback forms with a CD (Compact Disc) that contains a video record of the oral presentation. When they have filled out the form, advisors already declared their grades.

Owners of direct quotations were marked using a code system. It includes three parts separated by "-". The first part includes "A" for advisors or "S" for students. The second part indicates the year which is 2018 or 2019. The last part consisted of the participant number.

The program was not implemented to conduct a study. We conducted a program evaluation. After the evaluation, we obtained approval from the Dean's Office (document number: 100764/19.08.2019) to reveal the results of the program evaluation. Oral informed consent was obtained from all participants.

To prevent ethical problems, the feedback forms were filled out by students after students' grades were declared.

SPSS v.22.0 for Windows (Chicago, IL, USA) was used for the analysis of quantitative data. T-test was performed to determine whether the differences are statistically significant. Content analysis method was used for qualitative data which was obtained from open-ended questions. Qualitative data was examined and grouped under themes by all authors separately. If there was disagreement on some themes, the authors reached a consensus about these themes as a result of discussion sessions. The frequency of expressions in the opinions of students related to each theme was determined. Examples of direct quotations of students' and advisors' opinions were also provided in the results.

RESULTS

Quantitative results of the study are provided in Table 3. In both 2018 and 2019, the highest mean scores obtained from students were for using medical databases, and the lowest scores were for keeping up with the program. In 2018 and 2019, for advisors; the highest mean score was for using medical databases. In 2018, the lowest mean score was for keeping up the program. In 2019, the lowest was for "Students have learned the importance of academic language". In the item which is about keeping up the program, students' scores were significantly lower than advisors' scores in 2018 and 2019 both. Except for this item, advisors' scores were lower than students' scores for all the items.

Table 3. Quantitative results of the study (5-Point Likert scale).

	2018 Student (N=346)	Advisor (N=54)	p	2019 Student (N=355)	Advisor (N=59)	p	All Student (N=701)	Advisor (N=113)	p
1. I/Students can reach medical databases using internet.	4.51±0.66	4.31±0.69	0.044*	4.50±0.64	4.41±0.59	0.32	4.51±0.65	4.37±0.64	0.03*
2. I/Students can find the way of reaching qualified and appropriate evidence.	4.34±0.67	4.07±0.92	0.01*	4.43±0.68	4.31±0.70	0.23	4.39±0.68	4.20±0.82	0.008*
3. I/Students can identify a clinical problem and reveal it clearly.	4.35±0.69	4.22±0.81	0.23	4.32±0.74	4.22±0.70	0.33	4.34±0.72	4.22±0.75	0.12
4. I/Students can synthesize the evidence which is about a clinical problem.	4.34±0.72	4.06±0.89	0.009*	4.33±0.72	4.21±0.72	0.22	4.34±0.72	4.13±0.81	0.007*
5. I/Students can reach a conclusion using evidence.	4.43±0.71	4.26±0.91	0.11	4.37±0.72	4.28±0.69	0.34	4.40±0.71	4.27±0.80	0.07
6. I/Students can adapt information to a case.	4.40±0.68	4.13±0.93	0.01*	4.39±0.69	4.26±0.71	0.19	4.40±0.68	4.20±0.82	0.006*
7. I/Students can make presentation about reaching a conclusion process related to a clinical problem.	4.31±0.80	4.19±0.82	0.29	4.31±0.75	4.24±0.73	0.50	4.31±0.78	4.21±0.77	0.22
8. I/Students can work as a group.	4.28±0.92	4.06±1.07	0.11	4.21±0.95	4.21±0.76	0.98	4.24±0.94	4.13±0.92	0.25
9. I/Students have learned the importance of academic language.	4.31±0.84	4.09±0.89	0.07	4.28±0.82	4.03±0.74	0.03*	4.30±0.83	4.06±0.82	0.005*
10. I think the EBM program should be kept up.	3.66±1.22	4.04±1.09	0.03*	3.67±1.28	4.09±0.82	0.01*	3.66±1.25	4.06±0.96	0.001*

*: p<0.05

Table 4. Best sides of the program according to students in 2018, under themes with frequencies. (N=346)

Theme	Examples
Evidence-based medicine activities (f=164)	S-2018-117: "Comparing scientific articles was enjoyable" S-2018-203: "Screening article databases and reaching a conclusion were good" S-2018-229: "I have learned screening literature and to synthesize informations that I obtain from screening"
Group work (f=39)	S-2018-79: "Discussion with our group was enjoyable" S-2018-234: "I have learned working as a group member"
Presentation (f=23)	S-2018-8: "I have learned how to give a speech and I can control my panic now" S-2018-94: "I liked preparing a presentation"
Advisor (f=18)	S-2018-76: "I have benefited from our advisor's experience" S-2018-136: "Our advisor's attitude toward us was perfect" S-2018-263: "Guidance of our advisor"
Case (f=12)	S-2018-255: "Case was up to date" S-2018-331: "Case was interesting"
Other (f=17)	S-2018-133: "I did not like anything" S-2018-133: "Fourth year is exhaustive so I do not like it"
No Answer (f=93)	-

Table 5. Best sides of the program according to students in 2019, under themes with frequencies. (N=355)

Theme	Examples
Evidence-based medicine activities (f=192)	S-2019-31: "I've learned how to screen articles and to access the ones which I need" S-2019-54: "I discovered my medical research potential" S-2019-103: "Making research in order to reach a conclusion" S-2019-144: "I know how to find appropriate evidence now" S-2019-211: "I realized that searching for true information is not difficult" S-2019-252: "I liked learning new information by searching"
Presentation (f=45)	S-2019-66: "The best side absolutely was presentation. I improved my public speaking skill" S-2019-231: "For the first time I gave a speech in front of a crowd. It was exciting and nice"
Group work (f=28)	S-2019-200: "Group work. We learned so many things from each other" S-2019-297: "It saved us from boring class lessons for a limited time" S-2019-302: "Studying with group members was enjoyable"
Advisor (f=26)	S-2019-175: "Our advisor was warm-hearted. We always remember him" S-2019-207: "Being in personal contact with advisors and benefiting from her experience is a best way to learn" S-2019-240: "I think our advisor was great. His guidance was very helpful"
Case (f=23)	S-2019-77: "Cases were realistic" S-2019-95: "Cases were great"
Other (f=13)	S-2019-268: "I liked content of the case" S-2019-20: "I felt myself as a doctor when I was trying to solve the case" S-2019-98: "I don't like anything" S-2019-110: "I liked everything"
No Answer (f=52)	-

Table 6. Best sides of the program according to advisors in 2018, under themes with frequencies. (N=54)

Theme	Examples
Evidence-based medicine activities (f=14)	A-2018-24: "Article searching skills of students have improved" A-2018-29: "It contributed students' critical thinking skills" A-2018-50: "Synthesis of academic knowledge and evidence based approach"
Group work (f=6)	A-2018-27: "Their group work" A-2018-49: "Students' willingness to study as a group"
Presentation (f=2)	A-2018-17: "Their scientific presentations at this early age"
Other (f=9)	A-2018-52: "Their self-confidence and smiling faces" A-2018-39: "Well-planned education practice"
No Answer (f=26)	-

Table 7. Best sides of the program according to advisors in 2019, under themes with frequencies. (N=59)

Theme	Examples
Evidence-based medicine activities (f=13)	A-2019-7: "Witnessing the improvement of research skills of the students was nice" A-2019-25: "Students learned how to evaluate clinical problems and to analyze articles" A-2019-30: "It was good because they practiced screening articles"
Presentation (f=8)	A-2019-50: "It was good to see students' presentation skills" A-2019-52: "Even if it was short-time presentation but important for their self-confidence"
Motivation of students (f=7)	A-2019-9: "They have gladly participated group activities" A-2019-6: "Students had high motivation"
Case (f=2)	A-2019-59: "Cases contributed students' medical knowledge and they are intriguing"
Other (f=3)	A-2019-43: "That was good" A-2019-39: "Small group activities"
No Answer (f=30)	-

Table 8. The points that should be changed in program according to students in 2018, under themes with frequencies. (N=346)

Theme	Examples
Timing (f=55)	S-2018-4: "To arrange appropriate time with advisors was difficult" S-2018-87: "Program is good but it should be placed in first year" S-2018-109: "It should be in third year" S-2018-113: "It should be in first three years because fourth year has very busy schedule" S-2018-132: "It should be in fifth or sixth year" S-2018-215: "You should allocate meeting times, not us" S-2018-325: "It should not be in near time of our other exams"
Video record (f=29)	S-2018-137: "Video recording of presentation was unnecessary"
Decreasing minimum number of meeting with advisor (f=21)	S-2018-134: "Minimum number of meeting with advisor should be decreased, three times are enough"
Should not be changed (f=19)	S-2018-143: "Anything should not be changed"
Case (f=14)	S-2018-14: "We should determine cases, not you" S-2018-179: "Cases should be more detailed" S-2018-284: "Cases should be more interesting"
Should be removed completely (f=10)	S-2018-89: "Evidence based medicine program should be canceled completely because it was useless and waste of time"
Information about process (f=9)	S-2018-275: "You should more inform us about process"
Advisors (f=8)	S-2018-188: "Advisors should be more informed" S-2018-211: "Advisors had lack of information about process, they should learn more"
Duration (f=8)	S-2018-31: "3 months are not enough, its length should be increased"
Delivery method (f=7)	S-2018-77: "We should send our submission as an e-mail, not in a CD" S-2018-324: "Copying to CD is primitive, it should be via e-mail"
Should not be group work (f=4)	S-2018-120: "I wish I studied individually, not as a group"
Other (f=25)	S-2018-111: "Taking grade from advisors is stressful" S-2018-249: "It should include practices with real patients"
No Answer (f=142)	-

Table 9. The points that should be changed in program according to students in 2019, under themes with frequencies. (N=355)

Theme	Examples
Timing (f=91)	S-2019-74: "Session schedule should be determined by you, we hardly find appropriate time" S-2019-82: "It should not only in fourth year but also in other years" S-2019-91: "I've benefited from practices but it should be in third year instead of fourth year" S-2019-97: "I could not focus on these practices because there were intensive clerkship responsibilities in fourth year" S-2019-123: "Calendar should be determined by faculty, it's hard to find appropriate time for everyone" S-2019-153: "I think it should be in first three years because this year is full of clerkships and we cannot focus on these kinds of important practices" S-2019-176: "It should be in fifth year"
Decreasing minimum number of meeting with advisor (f=46)	S-2019-5: "We can reach our aims with less meeting" S-2019-151: "6 meeting is not necessary, it might be 4" S-2019-198: "I think meeting number is excessive. It should be decreased"
Video (f=43)	S-2019-24: "I don't know why we recorded a video" S-2019-210: "Video recording is needless"
Cases (f=20)	S-2019-169: "Cases should be more realistic" S-2019-183: "In some cases there was not enough detail" S-2019-193: "Some cases are very detailed but some other doesn't contain enough detail. They should be standardized"
Delivery method (f=11)	S-2019-229: "We should use e-mail instead of CD" S-2019-311: "CD is useless, I think it's not necessary"
Should not be changed (f=11)	S-2019-107: "In my opinion it was already perfect, there is no need to change" S-2019-188: "All was good, it should not be changed"
Advisor (f=8)	S-2019-13: "They should care these practices more" S-2019-275: "There were differences from advisor to advisor"
Should be more group work (f=7)	S-2019-25: "We could not work as a group. I think group members should be more contributor. If we work together we achieve more" S-2019-108: "Presentations should be prepared not individually but as a group" S-2019-276: "There should be more group work"
Should be removed completely (f=7)	S-2019-98: "It should be completely removed. We wasted our time"
No Answer (f=133)	-

Table 10. The points that should be changed in program according to advisors in 2018, under themes with frequencies. (N=54)

Theme	Examples
Arranging appropriate time (f=7)	A-2018-35: "We could hardly find the same hours which is available for students and us" A-2018-38: "You should arrange certain hours for meetings" A-2018-53: "Students are so busy with their exam preparations"
Decreasing minimum number of meeting with students (f=5) Case (f=4)	A-2018-7: "Minimum number of meeting with students should be decreased" A-2018-27: "Three meetings are enough" A-2018-19: "Cases should be relevant with our specialty field" A-2018-20: "Cases should not be determined by you"
Other (f=11)	A-2018-11: "There are so many students" A-2018-40: "I do not like it. Students were busy. It was waste of time. They already know how to screen databases and to find evidence" A-2018-49: "Students also should study at laboratory"
No Answer (f=29)	-

Table 11. The points that should be changed in program according to advisors in 2019, under themes with frequencies. (N=59)

Theme	Examples
Arranging appropriate time (f=10)	A-2019-7: "You should determine certain hours for meeting. Arranging it with all students was difficult because it could overlap with other programs" A-2019-13: "Meeting hours with students should not be flexible. It should be determined and declared to students and advisors by faculty"
Cases (f=3)	A-2019-19: "Cases should be more controversial" A-2019-23: "Cases should be related to advisor's specialty" A-2019-39: "You should change cases every year"
Presentation (f=3)	A-2019-52: "Students do not know how to make presentation so they should take a course about it"
Decreasing minimum number of meeting with advisor (f=2) Other (f=2)	A-2019-9: "Minimum number of sessions that we participate with students should be decreased" A-2019-30: "There was no need for video recording" A-2019-38: "Students were not aware of importance of evidence based medicine"
No Answer (f=39)	-

DISCUSSION

Quantitative results show that students perceived that they are able to perform EBM practices which are described in the first nine items of the feedback form. Also, advisors think that students met the abilities in these nine items. Therefore, the modified PEARLS method that has been implemented can be an option for teaching EBM but there is limited literature on this method. The only implementation of PEARLS method was performed by its developers with over 2000 students. According to their study, it has been rated by students as the most popular and helpful educational activity in their faculty (17).

For all the items except that one, the scores of advisors were lower than students'. Possibly, students could think that "we have improved ourselves by far when it is compared to our level that we have before the program" and advisors could think that "they have improved themselves but they have a long road to go ahead". When it comes to the last item, students and advisors think in a different way. Students' scores were lower than advisors' and also the difference was statistically significant. It could mean the advisors think that the practices should be continued but students do not think similarly as much as advisors. We believe the difference stems from students' busy schedules that we will explain in the following paragraphs. With a few changes in the structure of the program, we expect that students' views would come closer to advisors'.

Students enjoyed making a decision and the research process the most. They liked preparing presentation materials and oral presentations. The oral presentation was helpful to improve their presentation skills and coping with their anxiety. These reflections showed that the structure of the program was not the only kind that they liked but also contributes to their progress. Advisors were glad to see that the students' improvement in critical thinking and research skills as well as their group work and presentation skills. These were other indicators of the benefits of the program.

Instead of individual practices, group work was more preferable and enjoyable according to students.

Similar to this, Hunt et al. (11) reported that team learning is an effective method for teaching evidence-based medicine and a high level of student engagement was provided. As another similar finding, it was stated by Stockler et al. (17) that "tutors and assessors rate PEARLS among their most enjoyable and rewarding teaching experiences". In our program, however, still, there was a small proportion of our students who would prefer individual practices rather than group work. We should provide individual practices apart from group work in order to engage them more.

In the results, being in personal contact with a faculty member and learning about her/his personal experiences in professional life was impressive for students. We concluded that the students perceived the advisors as role models. The important role of the advisors or teachers can be seen in the study that Lam et al. (20) had identified barriers to the adoption of evidence-based medicine practice in clinical clerks. They stated that a lack of role models causes a negative impact on the way of learning evidence-based medicine. They also identified that a lack of support from clinical teachers is a barrier. In our study, we faced a similar result; the advisors who did not have enough information about the process could not provide a satisfying degree of support and they caused negative impressions. These negative impressions resulted from advisors who did not attend the informative session which is not compulsory. Even if there was no complaint about the lack of information of advisors in 2019, turning into compulsory can be a safe solution.

Students liked the intriguing and up-to-date cases. Some cases did not seem interesting and detailed enough according to them. There were students and advisors who want to determine cases. An option should be provided to students to determine cases by themselves under the guidance of advisors. It would be more appropriate for a program that is seeking harmony with constructivism.

Using different cases every year was another suggestion that comes from advisors in 2019. We used the same cases both in 2018 and 2019. We should change the cases every year but it would create time costs.

In literature, students' criticisms are focused on timing and workload in evidence-based medicine programs (20, 21). It was not different for our study, students complained particularly about timing. It was hard for them to arrange a meeting time with advisors. They wish that they were not responsible for arranging. In addition to this, advisors thought the same; arranging an appropriate time for meeting with students was difficult for them. We concluded that a fixed calendar for six sessions with advisors would be preferable since fixed hours prevent consuming their time for arranging. Besides, according to feedback, the fourth-year curriculum of the faculty was intensive so students could not totally focus on evidence-based medicine practices. We think that this problem can be overcome using a fixed calendar for meeting hours because they mostly complained about arranging appropriate time. In our study, there was a criticism that students were busy with other exams during our evidence-based practices. Maybe for this reason, although Hunt et al. (11) stated that students faced a busy schedule problem even in the second year, our students offered to replace the fourth year with other years such as the first three years, fifth year, and sixth year. Changing the year would be a solution if a fixed calendar does not work. When we change, we should keep in mind that the study that reported "students understand the main philosophy of evidence-based medicine in the clinical year when involved in its practical application with actual patients" (22). Some of the students and advisors thought that decreasing the minimum number of meetings would be right. This opinion could stem from the desire to reduce the amount of time which was spent on evidence-based medicine practices due to intensive year for students and patient care responsibilities for advisors. On the other hand, the minimum number of meetings could be excessive to achieve objectives. At the same time, some of the students and advisors thought that 3 months are not enough for this kind of activities and it should be longer, e.g. a year.

The second most complained part by students was video recording. Students described it as "unnecessary". In their opinion, oral presentation to the advisor and group members was enough. We should more clearly explain the aim of video recording to students. Maybe a session with advisors could be added to engage students to use video records for reflective thinking.

Some of the students complained about the delivery method of video records. According to them, it should be via e-mail rather than with a CD (compact disc). Their suggestion is appropriate in their view but a high amount of data cannot be easily delivered via e-mail. Purchasing a hosting service for this purpose would be another solution but it probably creates a financial burden to faculty.

There were students and advisors who describe the evidence-based practices as "useless" or "waste of time". They thought that these practices should be completely removed but they did not provide any detailed reason which is behind their views.

This study has limitations. A large proportion of students and advisors did not write any response to open-ended questions. The reason for their silence should be investigated. In addition to this, to explore the views of participants deeply and to specify defects of the process, a focus group interview would be more fruitful by comparison with a survey. Even if our objective was not to conduct a formal program evaluation, the most important limitation is that the current evaluation is only based on participants' views. It should be supported by higher levels of evaluation such as showing their improvement by using valid measures.

As a conclusion, integrating evidence-based practices with the activities such as preparing a presentation, public speaking, and recording oral presentation for reflecting on it is a novel approach. To systematically put this approach into practice, a modified PEARLS method is an option. In our program, students are pleased with these practices and activities especially in terms of making research, reaching a conclusion, presentation, and group work. Advisors are glad to see their improvements. There are complaints, which come from students and advisors, regarding some elements such as the timing of the practices, the determination way of the cases, and the delivery method of submissions. These are some of the troubles that we should fix for the next years. To determine the effectiveness of the method in teaching EBM, further studies are needed.

Conflict of interest

No conflict of interest was declared by the authors.

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