ORIGINAL ARTICLE

Effects of problem based learning approach on medical students' learning, satisfaction and engagement in embryology course

Background: Problem-based learning is a student-centered teaching method that encourages students to become active learners in the classroom and to improve the learning processes. The aim of this study was to compare two methods of teaching, problem- based learning (PBL) and lecture-based learning, in an embryology course.

Methods: This was a semi-experimental study conducted in Kurdistan University of Medical Sciences in 2012. Participants included a cohort of 42 medical students enrolled in an embryology course. Two different topics of embryology (veins and arteries) were taught using PBL and lecture methods to all participants. Both topics were compared regarding three items, students' participation, the clarity, interests and usefulness of the content taught, and the learning level (students' scores). Data analysis was performed via SPSS software.

Results: Using PBL method, the students' concentration on the subject doubled. There were significant differences between the two methods regarding students' perceptions of clarity and usefulness of the content. There were no significant differences between mean scores of PBL method and lecture in learning level. Furthermore, there was no significant difference between interest rates.

Conclusion: It could be concluded that when compared with lecture, PBL would increase students' concentration on the subject taught, the clarity of their understanding and their depth of learning. However, it does not seem to be the case in knowledge enhancement.

Key words: Education, Problem-based learning, lecture

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تعیین مستوی تأثیراسلوب حل المسئله علی العلم و الرضا و مستوی اندماج طلاب الطب مع موضوع الدرس فی علم الجنین

التمهید و الهدف: إن التعلیم المبتنی علی محوریة المسأله هو اسلوب مبتنی علی محوریة الطالب ایضا، الذی یؤدی الی تفعیل المتعلمین فی قاعة المحاضره و یحسن مجری التعلیم. هدف هذه الدراسه هو مقارنة اسلوب التدریس علی نمط المحاضره و اسلوب التعلم المبتنی علی محوریة المسأله فی درس علم الجنین.

الأسلوب: هذه الدراسه نصف تجریبیه وعددالمشارکون ٤٢ طالب من طلبه الطب من دورة المقدمات فی جامعه کردستان للعلوم الطبیه.تم تدریس الطلاب بحث الدوردة عبراسلوب المحاضره و من ثم تم تدریسهم بحث الشریان عبراسلوب المبتنی علی محوریة المسأله . و تم مقارنه الأسلوبین بواسطه استمارات و اختبار کتبی . النقاط التی تم مقارنتها کانت. ١- مستوی اندماج الطلاب مع الموضوع الدرسی ٢- مستوی الشفافیه،الفائده والعلاقه تجاه الموضوع الدرسی.٣- مستوی التعلم عند الطلاب. تم تحلیل المعلومات عبر برنامج SPSS

النتائج: فی مجال التعلیم المبتنی علی محوریة المسأله کان التمرکز مضاعف نسبتا الی اسلوب للمحاضره.کان هناك تفاوت واضح بین الاسلوبین فی مستوی الشفافیه و الفائده برغم من ان کانت علامه الاسلوب الاول اعلی عند الطلاب و لکن لم یکن هذا الأختلاف ذوقیمه.

الإستنتاج: تشیر النتائج الی أن اذا کان الهدف هو فقط انتقال المعلومات الی الطلاب فیصبح اسلوب المحاضره افضل و اسرع و اقل کلفة. لکن لاننسی ان اسلوب المبتنی علی محوریه المساله یرفع مستوی التمرکز و شفافیه المحتوی التعلیمی . التعلم العمیق و... التی لانحصل علیها من خلال اسلوب المحاضره.

الکلمات الرئیسیه: التعلیم ، حل المسأله،المحاضره .

تاثیر روش حل مسئله بر یادگیری، رضایتمندی و میزان درگیری دانشجویان پزشکی با موضوع درسی در درس جنین شناسی

زمینه و هدف: آموزش مسئله محور یک روش تدریس دانشجو محور است که باعث فعال بودن فراگیران در کلاس شده و در نتیجه باعث بهبود فرایند یادگیری میشود. هدف این مطالعه مقایسه دو روش تدریس سخنرانی و یادگیری مسئله محور در درس جنین شناسی است.

روش: این مطالعه یک مطالعه نیمه تجربی است و تعداد ۴۲ نفر از دانشجویان پزشکی دوره علوم پایه دانشگاه علوم پزشکی کردستان به شیوه سرشماری وارد مطالعه شدند. ابتدا به کلیه دانشجویان کلاس مبحث وریدها به شیوه سخنرانی و سپس مبحث شریانها به شیوه یادگیری مسئله محور تدریس شد. و مقایسه در موارد زیر بین دو روش تدریس بوسیله پرسش نامه محقق ساخته و آزمون کتبی انجام شد.١- میزان درگیری دانشجویان با موضوع درسی ٢- میزان شفافیت، مفید بودن، و علاقه نسبت به موضوع درسی ٣- میزان یادگیری دانشجویان. تجزیه و تحلیل داده ها با نرم افزار SPSS انجام شد.

یافته ها: در کلاس آموزش مبتنی بر حل مسئله تمرکز بر روی موضوع درسی دو برابر روش سخنرانی بود در شفافیت و مفید بودن موضوع درسی اختلاف معنی دار بین دو روش مشهود بود اما در مورد میزان علاقه اختلافی دیده نشد و میانگین نمره دانشجویان در روش آموزش مبتنی بر حل مسئله با وجود اینکه بالاتر بود اما تفاوت معنی دار نبود.

نتیجه گیری: نتایج نشان می دهد که اگر هدف از آموزش صرفا انتقال دانش باشد شاید روش سخنرانی از نظر زمانی وحجم محتوای قابل آموزش به صرفه باشد،اما استفاده از روش حل مسئله باعث افزایش تمرکز، شفافیت محتوای آموزشی، یادگیری عمیق و... می شود که این مهارتها با روش سخنرانی قابل دستیابی نیست.

واژه های کلیدی: آموزش، حل مسئله، سخنرانی

جنین شنانی یا ایمبریالوجی کے دروس میں پرابلم بیسڈ روش کی تاثیر اور اس سے طلباء کی رضایت اور اطمینان

بیک گراونڈ: پرابلم بیسڈ روش میں طلباء کو مرکزی کردار دیا جاتا ہے جس سے وہ دروس میں زیادہ دلچسپی لیتے ہیں جس کے نتیجے میں ان کی تعلیم پر مثبت اثرات پڑتے ہیں۔ اس تحقیق کا مقصد ایمبریالوجی کے دروس میں لکچر کی روش اور پرابلم بسیڈ روش کا موازنہ کرنا ہے۔

روش: یہ ایک نیم تجرباتی تحقیق ہے جس میں بیالیس طلباء نے شرکت کی اس تحقیق میں شرکت کرنے والے طلباء کا تعلق کردستان یونیورسٹی آف میڈیکل سائنس سے ہے۔ شرکاء تحقیق کو سب سےپہلے وریدوں کے بارے میں لکچر دیا گیا۔ اس کے بعد پرابلم بیسڈ روش سے طلباء کو شریانوں کے بارے میں بتایا گیا۔ اس کے بعد ان دوروشوں کا موازنہ کیا گیا جس کے لئے طلباء کے درمیاں سوالنامے بانٹے گئے۔ سوالنامے کے ساتھ ساتھ ان سے کتبی امتحان بھی لیا گیا۔ ان سوالناموں اور کتبی امتحان کے ذریعے یہ جاننے کی کوشش کی گئي کہ طلباء کس قدر سنجیدگي سے درس پر توجہ دیتے ہیں، کس قدر شفافیت اور دلچسپی سے کام کرتے ہیں اور کس قدر درس سمجھتے ہیں۔ ان معلومات کا تجزیہ ایس پی ایس ایس سافٹ ویر سے کیا گیا۔

نتیجہ: پرابلم بیسڈ روش سے یہ معلوم ہوا کہ طلباء لکچر کی نسبت موضوع پر دوبرابر توجہ دیتے ہیں، دونوں روشوں کے شفاف اور مفید ہونے کےبارے میں کافی فرق پایا جاتا ہے۔

سفارشات: اس تحقیق سے معلوم ہوتا ہے کہ اگرتعلیم کا ھدف طلباء تک محض معلومات کو منتقل کرنا ہے تو شاید لکچر کی روش اچھی ہے لیکن پرابلم بیسڈ روش سے طلباء کی توجہ میں اضافہ ہوتا ہے موضوع شفاف طریقے سے سمجھنے میں مدد ملتی ہے اور طلباء کی پڑھائي بھی بہتر ہوجاتی ہے یہ سارے فائدہ لکچر سے حاصل نہیں ہوتے۔

کلیدی الفاظ : تعلیم، پرابلم بیسڈ روش ۔ لکچر۔

INTRODUCTION

One of the most important steps in learning is selecting an appropriate teaching method that can encourage active learning and improve motivation in classrooms and accordingly promote the learning process. Generally Lecture is the most common method of academic education. In spite of the profuse information conveyed to a large audience in a short time, this method does not seem to be appropriate for teaching a variety of educational contents (1).

Problem solving or problem-based learning model is one of the active and student-centered approaches that encourage students to be independent in their learning and identify learners' needs for lifelong learning. This method enhances critical thinking skills and evidence-based clinical decision-making as well as teamwork and peer relationships (2).Using real patients' problems for learning is the main feature of PBL. This technique is used in both basic and clinical science, and it is a learning method in small groups where students discuss what they are taught. Teaching in small groups develops intellectual skills, such as reasoning, problem-solving and adopting the right attitude. Moreover, it is argued that PBL develops students' interpersonal skills, such as active listening, logical speaking, discussion and group leadership (3). There is a plethora of literature claiming that problem-based learning is an appropriate method for clinical training. In this method, students are responsible for their learning and assessment of learning goals, while teachers are responsible for directing students as facilitators of learning (4).

The courses in basic sciences are presented before students enter the hospital; thus, the content of the courses and their application in clinical practice are not well-integrated. High volume courses, time constraints, and the length of the general medicine course require considering educational strategies to increase motivation in students.

This study was designed to compare two instructional methods of problem-based learning and lecture method in teaching embryology. The study compared level of students' engagement with the subject, students' learning and finally transparency, usefulness, and interest in the subject.

METHODS

This was a semi-experimental study drawing on a statistical population of all the 42 medical students enrolled in an embryology course, in the second semester of the academic year 2011-2012, in Kurdistan University of Medical Sciences. All of the students who had selected the embryology course were included in the study, except for those who did not take the final exam. In this study, two main topics of arteries and veins in embryology course were selected to be taught using two different instructional methods. These two topics were selected because they approximately include an equal volume of content and identical difficulty level.

At the outset, the veins topic was presented using conventional lectures for all students. Then, using problem-based learning approach the veins topic was taught. It took 2 hours for veins topic and 6 hours for arteries to be taught.

In the first session of problem-based learning method, all the 42 students were divided into 6 groups based on their seating arrangement in the class ('15). Primarily, the teacher gave a brief explanation about the problem-based teaching methods (15') and a clinical problem was introduced to the groups. Next, the students were directed to classrooms, equipped with internet access, in order to search for evidence they needed. One or two of students in each group were sent to search in the library.

Later, the whole class reunited to discuss the result of teamwork and to brainstorm ('30). At this point, the teacher gathered all groups to provide feedback to the ones which were presenting their findings. Finally, in the reunion, all groups were posed with another clinical question and were asked to continue their search on the internet and in the library to find relevant resources and articles.

In the second session, students in classrooms, which were equipped with computers, examined the broader topics of interest and discussed them ('40). A member of each group was selected to present the findings in class ('60). Afterwards, 7 related issues were given to the students. The students were asked to summarize the material for the next meeting and review the related literature ('10); in addition, in each session one of the students was assigned as the group representative and he/she became responsible for guidance and coordination of the related members.

In the third session, group representatives asked students to present their findings and search results. All findings were depicted on slides and were prepared for presentation for the whole class after being discussed by students ('50).The teacher, also, gave appropriate feedback on all the students' activities, such as teamwork, group participation and the desired responses. Finally, the students reunited and presented the results and solutions obtained ('40). In the end, the teacher offered additional explanations drawing on the ideas of other students ('30).

The assessment of the students focused on the three following criteria:

1 - Level of students' engagement with the subject

2 - The amount of transparency, usefulness, and interest in the subject

3 - Students' Learning level

To see if the first objective, i.e. student involvement, was achieved, the students were given an envelope containing a question in the middle of each session*: "What were you thinking about, exactly before opening this envelop?";* their responses were divided into three categories: 1 - exclusively about the subject, 2–related to the classroom, 3 - topics unrelated to classes. The data were analyzed subsequently using descriptive statistics.

The second objective was to assess the quality of teaching (transparency, usefulness, and interest in the subject). At the end of each session, in both lecture-based and problem-based methods, a questionnaire was distributed among students. The questionnaire assessed three items: the degree of transparency, the interest rate and the usefulness of the method, using a traditional 5 point Likert scale ranging from "highly disagree to highly agree". The data were, then, analyzed using paired sample t-test.

To assess students' learning level, all students were assessed through a comprehensive examination on both topics (veins and arteries), in which questions were peer-checked by 2 people. The scores were analyzed using SPSS software and paired samples t tests.

RESULTS

All the 42 students in the class participated in the study. In response to the question "*What were you thinking about, exactly before opening of this envelop?*", analysis revealed that 50% of students in Problem-based learning class were focused on the main issue. Nevertheless, only about 21 % of students in lecture-based traditional class were focused on the main issue. The results are presented in Table 2.

Regarding the second issue, the quality of teaching, interest, transparency and usefulness of the subject were investigated. As with the issue of transparency, the results showed that the intervention group scores were significantly higher than the control group ($p < 0.05$). On usefulness of teaching methods, the scores of the intervention group were significantly higher than the control group scores ($p < 0.05$). Conversely, there were not significant differences between the two groups score in the level of interest and motivation, ($p > 0.05$) (Table 3).
Students' learning and understanding was assessed by means of a written test. The results showed the mean score of students in problem-based learning method was higher than conventional lectur-based method, but this difference was not statistically significant ($p > 0.05$).

Table 1. Distribution of responses regarding the level of engagement with the subject

Teaching Methods	Focus on subject	Focus on concepts related to class	Focus on concepts unrelated to class	Total
PBL	21(%50)	19 (%45.24)	2 (%4.7)	42 (%100)
Lecture-based	9 (%21.45)	25 (%59.56)	8 (%9.19)	42 (%100)

Table 2. responses regarding the involvement with the subject

	Specifically about the subject (person)	Concepts associated with the class (person)	Issues unrelated to class (people)
PBL classroom	1. Talk about the early stages of vascular development (2)	1. Talk about molecular evolution vessels (4)	1. This topic is too important (1)
	2. Traced the evolution of the arteries (2)	2. Talk about coarctation of the aorta (2)	2. I feel good about the lesson (1)
	3. Talk about umbilical and yolksac vessels (2)	3. Talk about double pharyngeal arteries Arch(3)	
	4. Answers to questions (2)	4. Talk about the right aortic arch (3)	
	5. Discussion with Group (3)	5. Talk about the right sub-clavian artery anomalies (3)	
	6. Talk about Arch pharyngeal artery (4)		
	7. Talk about the circulation of the fetus and newborn (3)		
	8. Talk about the circulatory changes at birth (3)		
lecture Classroom	1. Thinking about the subject matter (1)	1. Speaking with other students(2)	1. How do I pass the test (2)
	2. Looking at the slides (1)	2. Thinking about the speech (3)	2. How do I solve my financial problems (1)
	3. Taking notes (1)	3. Eating (3)	3. I have little time to study (1)
	4. Taking notes and listening (1)	4. Getting the slide of professor (2)	4. What can I do on weekends (1)
	5. Listening (1)	5. Break up (3)	5. Reading text messages (2)
	6. Writing and highlighting (1)	6. Thinking about the anatomy (2)	6. Listening to music with headphone (1)
	7. What is important in this session(1)	7. I'm tired (3)	
	8. How do I pass the course (1)	8. I should complete the notes (4)	
	9. Try to learn by listening and taking notes (1)	9. Thinking about the next class (4)	
		10. Histological buybooks (2)	

Table 3. Average scores given to the quality of teaching in both groups

Evaluationtopic	Subject transparency (SD)	Interestrates (SD)	Usefulness (SD)
Lecture	3.43±0.667	3.24±0.690	3.24±0.617
PBL	3.69±0.604	3.63±0.611	3.60±0.665

Table 4. Average scores on the learning intervention and control groups

Subject	Teaching method	Average scores
Veins system	Lecture	14.64±1.56
Arteries system	Problem solving	14.83±1.87

DISCUSSION

This study was designed to compare the impact of lecture and problem-based learning, in an embryology course, on students' motivation levels, clarity of subject, and the usefulness of the course. "It should be noted that learning does not happen without a deep understanding of the subject, and deep understanding requires attention. The more the learners pay attention to the subjects, the more it is likely for them to learn and understand them. This is also true with motivation. Motivation can be defined as our tendency to perform activities for known rewards. Motivation is essential in learning and influences intelligence "(3). Therefore, any teaching method that increases students' concentration and motivation will increase learning. The results showed that students in problem-based method compared with lecture-based method concentrate twice more on the subjects. Students thought subject transparency and usefulness of the method in problem-based method are significantly higher than the lecture method. However, there was no significant difference between two methods regarding the development of motivation.

Several studies have been conducted in Iran and elsewhere to compare two or more different instructional methods. Literature review shows different results in this regard. The differences could be related to teachers' experience in using these methods, the relevance of the subject, the teacher's ability to guide a small group, and type of test database used. Abolhasani et al. in their study on students' learning in PBL concluded that problem-based methods in nursing education enhance learning in both clinical and basic sciences (5).

A study conducted by Mehdizadeh et al. to compare the anatomy taught by lecture and problem solving, showed that students' motivation and scores in problem solving method were significantly higher than lecture method, though enhancement of students' motivation in the above study is not consistent with the results of the present study (6). In another study Kulayni et al. compared two methods of lectures and problem solving in a biology course and concluded that students' scores in problem solving were higher than lecture based method (7).On the contrary a survey conducted on American residents indicated that scores of learners in lecture method were higher than problem solving method (8). Another study in India found that histology and embryology were better taught through lectures (6). In Charite medical school two curriculums of "problem solving" and "traditional" were conducted. Based on the traditional curriculum students spend the first two years on basic sciences and if they pass the final exams at the end of two years, they can enter the clinical phase. But in the problem solving method, clinical training starts from the first semester, while attending seminars is mandatory and from the fifth, semester more focus is placed on clinical sciences. The results revealed that up to the fourth semester, both groups' level of knowledge acquisition were equal. In semester four, however, a sharp increase of knowledge attainment was noticed in basic science. Higher knowledge attainment continued in lecture group throughout the course (9).

Bligh believes that the lecture is as effective as other methods for transmitting information. Nevertheless, lecture is less effective for fostering thinking and adopting the right attitude when compared with other methods. On the other hand, although problem solving method has many advantages, it should not be ignored that the structured lecturing is effective to convey teacher's experiences. Arousing students' curiosity by asking questions, the teacher's enthusiasm for teaching the desired content, feedback, and finally testing make the result of lecture very effective (3).

Since the samples in this study were selected from an available population, the results cannot be generalized. Other investigations using random sampling and larger sample size should be designed to gain a better understanding of the usefulness of the methods.

The results of this study and other similar investigations indicate that there is no difference between lecture and problem based learning in knowledge transfer. However, it could be concluded that provided the lecture is structured and systematic enough, it could obtain even better results. On the other hand, many studies show that problem solving method enhances other generic skills, such as critical thinking (5), Research, long-life and meaningful learning. These skills cannot be achieved through mere lectures. The limitations of this study include lack of random sampling, using a convenient sampling method, teaching through problem-solving approach to be more time-consuming due to the specific nature of this type of training, lack of identical teaching content and eventually, the possible differences in the degree of difficulty of the questions.

REFERENCES

1. Safavi A, koliatraveshhavafonontadris. Entesharatmoaser, 2007.[Persian]
2. Dent J A, Harden R M. A PRACTICAL GUIDE FOR MEDICAL TEACHERS. ELSEVIER, Second edition 2005.
3. Newble D, Cannon R. A Handbook for Medical Teachers. MTP Press Limited, 1990.
4. Sabahi R, Toghyani far N, Mokhtari L, Modaresi Z. Introdaction to PBL. Isfahan University of medical sciences, Educational Development Center, 1998.
5. Abolhasani S, Haghani F. Problem-based Learning in Nursing Education: A Review Article. IJME. 2011; 10 (5) :726-734.
6. Mehdizadeh M, Kermaniyan F, Iravani S, MArkaziMoghadam N, Shayan S. Comparing Lecture and Problem-based Learning Methods in Teaching Limb Anatomy to First Year Medical Students. IJME. 2008; 7 (2) :379-388.
7. Koleini N, Farshidfar F, Shams B, Salehi M. Problem Based Learning or Lecture, A New Method of Teaching Biology to First Year Medical Students: An Experience. IJME. 2003; 3 (2) :57-63.
8. Jafari M. Comparison of Lecture and Blended Teaching Methods on Learning and Satisfaction of Medical Students in Biochemistry Course . IJME. 2012; 12 (7) :488-497.
9. Nouns Z, Schauber S, Witt C, Kingreen H &Brauns K, Development of knowledge in basics c a comparison of two medical curricula. Medical Education 2012: 46:1206-1214.