



Batool Eghbali¹, Mitra Moodi², Zoya Tahergorabi^{3,4}
¹Department of Family and Community Medicine, School of Medicine, Birjand University of Medical Sciences, Birjand, Iran
²Social Determinants of Health Research Center, Department of Health Promotion and Education, School of Health, Birjand University of Medical Sciences, Birjand, Iran
³Medical Toxicology and Drug Abuse Research Center, Department of Physiology, School of Medicine, Birjand University of Medical Sciences, Birjand, Iran

⁴School of Medicine, Birjand University of Medical Sciences, Ghaffari St. Birjand, 9717853577 Iran

Tel: +989123835626
 Email: z.tahergorabi@yahoo.com,

Viewpoints of second year medical students about Early Clinical Experience (ECE) in teaching endocrine and gastrointestinal physiology

Background: The importance of Early Clinical Experience (ECE) in education is increasing. This study aimed to investigate the viewpoints of medical students about ECE in teaching endocrine and gastrointestinal physiology lessons.

Method: This study was conducted on 96 second-year medical students in endocrinology and gastrointestinal physiology classes including 15 sessions in the first and second academic semesters of 2022-2023. The first 45 minutes of the class was taught via the lecture method, after the 5 minutes break, the second 45 minutes of the class started by lecture method and a question based case-scenario related to the teaching subject of the same session was asked from standard questions of United States Medical Licensing Exam (USMLE). A researcher-made questionnaire was used at the end of sessions to assess the students' viewpoints. The questionnaire included 12 questions about ECE teaching method, quality of learning, content quality, and student motivation. They were rated by a 5 point Likert scale from completely disagree to completely agree.

Results: The mean age of students was 20.82 ± 1.37 years and 51 (53.1%) of them were male. The mean score of overall students' motivation, quality of teaching and learning quality was 6.85 ± 1.97 , 7.16 ± 2.46 , and 14.47 ± 3.8 respectively.

Conclusion: This study suggested the early clinical exposure in teaching endocrine and gastrointestinal physiology. This educational method can be used to solve problems such as students' understanding of the lack of connection between basic and clinical sciences to increase their motivation for learning.

Keywords: Early Clinical Experience, Endocrine and Gastrointestinal Physiology, Medical Students, Viewpoints, Medical Education

وجهات نظر طلاب الطب في السنة الثانية حول الخبرة السريرية المبكرة (ECE) في تدريس فسيولوجيا الغدد الصماء والجهاز الهضمي

الخلفية: تزايد أهمية الخبرة السريرية المبكرة (ECE) في التعليم. هدفت هذه الدراسة إلى التعرف على آراء طلاب الطب حول ECE في تدريس دروس فسيولوجيا الغدد الصماء والجهاز الهضمي.

الطريقة: أجريت هذه الدراسة على 96 طالب طب في السنة الثانية في فصول الغدد الصماء وعلم وظائف الأعضاء الهضمي، بما في ذلك 15 جلسة في الفصلين الدراسيين الأول والثاني من 2022-2023. تم تدريس أول 45 دقيقة من الفصل بطريقة المحاضرة، وبعد استراحة مدتها 5 دقائق، بدأت الـ 45 دقيقة الثانية من الفصل بطريقة المحاضرة وتم طرح سيناريو حالة قائم على الأسئلة يتعلق بموضوع التدريس بنفس الجلسة من الأسئلة القياسية لامتحان الترخيص الطبي بالولايات المتحدة (USMLE). وتم استخدام استبيان من إعداد الباحث في نهاية الجلسات لتقييم وجهات نظر الطلاب. اشتمل الاستبيان على 12 سؤالاً حول طريقة تدريس تعليم الطفولة المبكرة، وجودة التعلم، وجودة المحتوى، وتحفيز الطلاب. وتم تصنيفهم بمقياس ليكرت المكون من 5 نقاط من غير موافق تماماً إلى موافق تماماً.

النتائج: كان متوسط عمر الطلاب 20.82 ± 1.37 سنة وكان 51 (53.1%) منهم من الذكور. كان متوسط درجة تحفيز الطلاب بشكل عام وجودة التدريس وجودة التعلم 6.85 ± 1.97 و 7.16 ± 2.46 و 14.47 ± 3.8 على التوالي.

الاستنتاج: تقترح هذه الدراسة التعرض السريري المبكر في تدريس فسيولوجيا الغدد الصماء والجهاز الهضمي. يمكن استخدام هذا الأسلوب التعليمي لحل مشكلات مثل فهم الطلاب لعدم وجود ارتباط بين العلوم الأساسية والسريرية لزيادة دافعيتهم للتعلم.

الكلمات المفتاحية: الخبرة السريرية المبكرة، فسيولوجيا الغدد الصماء والجهاز الهضمي، طلاب الطب، وجهات النظر، التعليم الطبي

دیدگاه دانشجویان پزشکی سال دوم درباره تجربه زودرس بالینی در تدريس فیزیولوژی غدد و گوارش

زمینه و هدف: اهمیت تجربه زودرس بالینی (ECE) در آموزش در حال افزایش است. این مطالعه با هدف بررسی دیدگاه دانشجویان پزشکی در مورد ECE در تدريس دروس فیزیولوژی غدد درون ریز و دستگاه گوارش انجام شد.

روش: این مطالعه بر روی 96 دانشجوی سال دوم پزشکی در کلاس درس فیزیولوژی غدد درون ریز و دستگاه گوارش شامل 15 جلسه در دو نیمسال اول و دوم تحصیلی 1402-1401 انجام شد. اولین 45 دقیقه کلاس به روش سخنرانی تدريس شد، پس از 5 دقیقه استراحت، 45 دقیقه دوم به روش سخنرانی برگزار و یک سوال بر اساس یک مورد سناریو مرتبط با موضوع تدريس همان جلسه مطرح و از سوالات استاندارد آزمون مجوز پزشکی ایالات متحده (USMLE) پرسیده شد. در پایان جلسات برای سنجش دیدگاه دانشجویان از پرسشنامه محقق ساخته استفاده شد. این پرسشنامه شامل 12 سوال در مورد روش تدريس ECE، کیفیت یادگیری، کیفیت محتوا و انگیزه دانشجوی بود. سوالات با مقياس ليكرت 5 گزینه ای از کاملاً مخالف تا کاملاً موافق رتبه بندی شدند.

یافته ها: میانگین سنی دانشجویان در دو کلاس 20.82 ± 1.37 سال و 51 (53.1%) نفر از آنها در دو کلاس مذکور بودند. میانگین نمره کلی انگیزه دانشجویان، کیفیت تدريس و کیفیت یادگیری بترتيب 6.85 ± 1.97 ، 7.16 ± 2.46 و 14.47 ± 3.8 بود.

نتیجه گیری: ما تجربه زودرس بالینی در تدريس فیزیولوژی اندوکراین و گوارش را توصیه می کنیم. این شیوه آموزشی می تواند برای حل مشکلاتی مانند درک دانشجویان از عدم ارتباط علوم پایه و بالینی استفاده شود و انگیزه آنها را برای یادگیری افزایش دهد.

واژه های کلیدی: تجربه زودرس بالینی، فیزیولوژی اندوکراین و گوارش، دانشجویان پزشکی، دیدگاه، آموزش پزشکی

اینڈوکرائن اور معدے کی فزیالوجی کی تعلیم میں ابتدائی طبی تجربہ (ای سی ای) کے بارے میں دوسرے سال کے میڈیکل طلباء کے نقطہ نظر

پس منظر: تعلیم میں ابتدائی طبی تجربہ (ای سی ای) کی اہمیت بڑھ رہی ہے۔ اس مطالعہ کا مقصد اینڈوکرائن اور معدے کی فزیالوجی کے اسباق پڑھانے میں ECE کے بارے میں میڈیکل طلباء کے نقطہ نظر کی چھان بین کرنا تھا۔

طریقہ: یہ مطالعہ 2022-2023 کے پہلے اور دوسرے تعلیمی سمسٹروں میں 96 سیشن سمیت اینڈوکرائن اور معدے کی فزیالوجی کی کلاسوں میں دوسرے سال کے 96 میڈیکل طلباء پر کیا گیا۔ کلاس کے پہلے 45 منٹ لیکچر میتھڈ کے ذریعے پڑھائے گئے، 5 منٹ کے وقفے کے بعد کلاس کے دوسرے 45 منٹ کا لیکچر طریقہ سے شروع ہوا اور اسی سیشن کے تدریسی مضمون سے متعلق ایک سوال پر مبنی کیس سناریو پوچھا گیا۔ ریاستہائے متحدہ کے میڈیکل لائسنسنگ امتحان (USMLE) کے معیاری سوالات۔ طلباء کے نقطہ نظر کا اندازہ لگانے کے لیے سیشن کے اختتام پر محقق کا بنایا ہوا سوالنامہ استعمال کیا گیا۔ سوالنامے میں ECE تدریسی طریقہ، سیکھنے کے معیار، مواد کے معیار، اور طالب علم کی حوصلہ افزائی کے بارے میں 12 سوالات شامل تھے۔ ان کو مکمل طور پر متفق ہونے سے لے کر مکمل طور پر متفق ہونے کے لیے 5 پوائنٹ لائیکرت اسکیل سے درجہ بندی کیا گیا تھا۔

نتائج: طلباء کی اوسط عمر 20.82 ± 1.37 سال تھی اور ان میں سے 51 (53.1%) مرد تھے۔ طلباء کی مجموعی حوصلہ افزائی، تدریس کے معیار اور سیکھنے کے معیار کا اوسط اسکور بترتيب 6.85 ± 1.97 ، 7.16 ± 2.46 اور 14.47 ± 3.8 تھا۔

نتیجہ: اس مطالعے نے اینڈوکرائن اور معدے کی فزیالوجی کی تعلیم میں ابتدائی طبی نمائش کا مشورہ دیا۔ یہ تعلیمی طریقہ مسائل کو حل کرنے کے لیے استعمال کیا جا سکتا ہے جیسے کہ طلبہ کی بنیادی اور طبی علوم کے درمیان تعلق کی کمی کو سمجھنا تاکہ ان کے سیکھنے کی حوصلہ افزائی ہو سکے۔

کلیدی الفاظ: ابتدائی طبی تجربہ، اینڈوکرائن اور معدے کی فزیالوجی، طبی طلباء، نقطہ نظر، طبی تعلیم

INTRODUCTION

The strong recommendation report of Abraham Flexner stated that the basic sciences are fundamental in practice of medicine and should be reflected in medical training. He was appointed in 1910 by the American Medical Association and the Carnegie Foundation to assess medical education in Canada and America (1). Based on Flexner recommendation, there is a curriculum of 2+2 model pre-clinical sciences in most medical schools worldwide. It is taught in the first 2 years and clinical sciences in the second half of the course (2). However, we know many medical students feel that preclinical science is irrelevant to medical practice (3) therefore, they respond to this challenge by superficial learning rather than deep understanding (3). The traditional method (only lecture) has limited success in enabling students to manage a variety of cases using knowledge and also, most medical students during the clinical phase forget what have learned during the first 2 years of education (4). Based on the above mentioned challenge, a paradigm shift has occurred in the curriculum by many medical schools worldwide in recent years (5). Although the process of change is difficult due to need for alteration in the mindset and attitudes of the faculties (6). Medical educationists focused on need for integrating basic and clinical medical sciences or bridging connections between academic knowledge and practice, because they believe that it can create more attention and excitement in learning (7). In this context, one of the medical education research priorities according to the need for training of professional expert physicians is the movement of medical education towards new curricular models including, the Early Clinical Experience (ECE) in training of basic sciences that has a key role to reinforcing of curriculum and increasing the value of it (8).

ECE is a teaching-learning approach in which clinical contact occurs in the early years of the curriculum. It can be done at different settings broadly divided into three groups including classroom setting, Hospital-based setting, and Community setting. In classroom setting ECE as an educational strategy includes a) direct arrangement of patients/cases to the classroom, b) ready-made case scenario discussion and c) discussion of clinical material such as patient case record sheets, electrocardiogram, X-rays, computed tomography scan, etc (9).

The most beneficial aspects of ECE program or early contact with the clinical environment in the preclinical period is emphasizing on the importance of basic sciences in clinical medicine (10). The Introduction of clinical examples at an early stage of training can draw deep features of basic science concepts for medical students. Furthermore, it can enhance deep learning rather than superficial learning of basic sciences by teaching the healthcare to them in order to take care of the patients. Also, it can improve the attitudes of medical students about education with an increase in their ability to succeed in medical practice and hence, professional satisfaction (11).

Integration in medical education includes horizontal and vertical integration. Horizontal integration is defined in the

form of various disciplines such as anatomy, physiology, and biochemistry, for example the cardiovascular system are taught simultaneously. However, vertical integration is recognized with combination of the basic medical and clinical sciences in the early years of the curriculum (12). Accordingly, various vertical and horizontal integrated practical interventions have entered in medical education curriculum in different universities (13-15). Vertically integrated curriculum by Wijnen-Meijer et al. was defined as provision of early clinical experience; integration of biomedical sciences and clinical cases; long clerkships during the final years of training; and fostering of increasing levels of clinical responsibility within undergraduate training (13). Among basic sciences, physiology is highly related to clinical medicine. Therefore, it is a good choice of integration for better understanding of students. The acquisition of abundant knowledge permanently could not enable the student to use a massive amount of knowledge in clinical situations (16). In parallel, teaching endocrine and gastrointestinal physiology in an effective manner to 2nd year medical students is challenging and various methods have been studied including case-stimulated learning (17), problem based learning (18), patient-centered learning (19) and multiple format sessions (20); but in most of them the effectiveness of the program and quantitative measurement of ECE learning outcomes have not been cleared. However, case-scenario based learning is learner-centered and in this method students are encouraged to think critically and reinforce their communication skills. Therefore, the present study aimed to investigate the viewpoints of medical students about their ECE in teaching endocrine and gastrointestinal physiology lessons.

METHODS

This descriptive-analytical study was conducted on 96 undergraduate second-year medical students in 2 classes during 2 consecutive semesters in 2022-2023 in the medical school of Birjand University of Medical Sciences.

Usually, at the beginning of each academic semester, students are asked to read the lesson plan and educational objectives from the website of the Department of Physiology in the School of Medicine. The endocrine physiology and gastrointestinal physiology classes including 15 sessions were in both the first and second academic semesters of 2022-2023. They were both taught by the same teacher. At first, the education was done by lecture method with the use of PowerPoint software, board marker, and whiteboard, for example, the physiology of the thyroid gland, in the first 45 minutes of the class. Then, after 5 minutes break, the second 45 minutes of the class was held by lecture method, and at the end of the class or during the second 45 minutes, in a time that it was assumed the students were able to answer the asked question, a question based on a clinical case related to the teaching subject of the same session was asked. The question was taken from the standard questions of United States Medical Licensing Exam (USMLE) of the book "Ganong's medical physiology examination & board review" (21). If there was enough time, 2 clinical questions were asked in one session. A case example of endocrine and gastrointestinal physiology has been given below.

A 50 year old woman comes to her physician complaining of unexplained weight gain and memory problems. Physical examination reveals a yellowing of her skin without discoloration of her sclera. Circulating levels of TSH are increased. A blood test is likely to reveal increased plasma levels of

- A. cholesterol
- B. albumin
- C. RT3
- D. Iodide
- E. TBG

A 50 year old man comes to see his clinician complaining of severe epigastric pain, frequent heartburn and unexplained weight loss of 20 IB over a 6 month period. He claims to have obtained no relief from over the counter H2 antihistamine drugs. He is referred to a gastroenterologist; the upper endoscopy reveals erosions and ulcerations in the proximal duodenum and an increased output of gastric acid in the fasting state. The patient is most likely to have a tumor secreting which the following hormones?

- A. Secretin
- B. Somatostatin
- C. Motilin
- D. Gastrin
- E. Cholecystokinine

One student was chosen from the list of students to stand next to the whiteboard for writing the question and 5 answer options on the whiteboard so that other students could see the question and think about it. Five minutes time were given to them to answer to the question. The students were grouped in 5. Students discussed and exchanged opinions within their groups. Then the student in question was asked to select of the correct option and give a logical reason for his or her answer, and also why the other options were false. If the student in question could not answer, other students' groups answered the question. In the end, the student who gave a correct and complete answer was given a positive score, which also affected the student's end-of-semester exam score. This method was used for 10 sessions of the endocrine physiology class and 5 sessions of the gastrointestinal physiology class. Also, after the students finished answering the question, the key points of the question were explained by the teacher and the questions of the students were answered in relation to the case question. Furthermore, in the final exam, questions similar to those asked in class were used.

At the end of 15 class sessions in each academic semester a researcher-made questionnaire was used to assess students' viewpoints. The questionnaire was validated by the faculty members of Physiology Department and the Education Development Office (EDO) of the medical school. The Cronbach's alpha coefficient 0.84 was also calculated for the reliability of the questionnaire. The questionnaire had 12 questions; questions 1 and 6 for teaching method assessment, questions 7, 8, 9 and 12 for quality of learning assessment, questions 2,3,4 and 5 for content quality assessment and questions 10 and 11 for student motivation assessment ranged from completely disagree, disagree, no opinion, agree and completely agree upon a 5 point Likert scale. The questionnaire was completed in the first and second academic semesters of 2022-2023. The inclusion criteria included all the second-year medical students in basic sciences course who had chosen the physiology of endocrine and gastrointestinal systems. Students who were absent more than two sessions out of 15 sessions were excluded from the study. Completing the questionnaire was optional and there was no need to mention the name in order to keep the students' information confidential. The collected data were statistically analyzed using SPSS version 16 software. Descriptive statistical testes (frequency, percent) and one-

sample t-test were used for data analysis.

RESULTS

The total students in 2 consecutive semesters were 140 undergraduate second-year medical students. Among them, 96 completed the questionnaire. Others did not do it because of absence or illness.

The mean age of students in two classes was 20.82 ± 1.37 years; and 51(53.1%) of them in both classes were male. 62.4% of students agreed and completely agreed that the ECE is a new method of teaching endocrine and gastrointestinal physiology and found it attractive. 50% of students considered this teaching method effective in learning endocrine and gastrointestinal physiology. 70.8% of students disagreed and completely disagreed with the difficulty of ECE. The frequency distribution of viewpoints of students about teaching method, quality of learning, content quality, and students' motivation is shown in Table 1. The mean score of teaching components is presented in Table2.

DISCUSSION

The present study showed that 62.4% of students agreed and completely agreed that this teaching method in endocrine and gastrointestinal physiology is a new method of teaching in basic science and considered it attractive. It is in agreement with the study by Rafique in Department of Physiology, college of Medicine, university of Dammam Kingdom of Saudi Arabia (2014) on 104 second year MBBS class that 90 questionnaires were returned by students. This study was designed as case scenario expression at the beginning of the lecture related to respiratory physiology that 89% of students found interesting in teaching physiological concepts in integration with clinical scenarios (22). A possible explanation is that the use of clinical scenarios and clinical examples in teaching sessions of basic medical sciences helps to medical students to understand the importance of learning basic sciences and generates interest among students (6). Also, The study by Mattout et al. (2023) in the College of Medicine, Dar Al Uloom University (DAU), KSA on 50 third-year medical students showed that 94% were satisfied with realistic simulation case scenario method and 92% of them reported that this method was more effective in terms of achieving learning objectives (23). Also, the present results demonstrated that 56.2% of students agreed and completely agreed with holding this teaching method for

Table 1. viewpoints of students about teaching method, quality of learning, content quality, and students' motivation

| Questions | Degree of agreement | | | | | |
|--------------------|---|-----------|------------------|-----------|-----------|-----------|
| | Completely disagree | | Completely agree | | | |
| | 1 n(%) | 2 n(%) | 3 n(%) | 4 n(%) | 5 n(%) | |
| Teaching Method | Q1:It was a new method of teaching basic science and it was attractive to me | 11(11.5%) | 9(9.4%) | 16(16.7%) | 30(31.2%) | 30(31.2%) |
| | Q6: I agree with holding this teaching method for other lessons as well | 12(12.5%) | 6(6.2%) | 24(25%) | 25(26%) | 29(30.2%) |
| Content Quality | Q2:It was related to the taught subject | 5(5.2%) | 2(2.1%) | 13(13.5%) | 30(31.2%) | 46(47.9%) |
| | Q3:It was easy to understand | 12(12.5%) | 16(16.7%) | 31(32.3%) | 25(26%) | 12(12.5%) |
| | Q4:It was obscure | 20(20.8%) | 31(32.3%) | 26(27.1%) | 12(12.5%) | 7(7.3%) |
| | Q5:It had no clear connection with the taught subject | 50(52.1%) | 24(25%) | 13(13.5%) | 7(7.3%) | 2(2.1%) |
| Learning Quality | Q7:I could learn physiology better | 12(12.5%) | 8(8.3%) | 17(17.7%) | 39(40.6%) | 20(20.8%) |
| | Q8:more difficulty for learn of physiology lesson | 38(39.6%) | 30(31.2%) | 16(16.7%) | 7(7.3%) | 5(5.2%) |
| | Q9:Understand the application of physiology in clinical situations | 3(3.1%) | 10(10.4%) | 19(19.8%) | 35(36.5%) | 29(30.2%) |
| | Q12:I will be more prepared for the end-of-semester exam of physiology lesson | 13(13.5%) | 10(10.4%) | 29(30.2%) | 27(28.1%) | 17(17.7%) |
| Student Motivation | Q10:I do more try for learn of physiology lesson | 7(7.3%) | 13(13.5%) | 28(29.2%) | 30(31.2%) | 18(18.8%) |
| | Q11:Decrease in My self-confidence in learning physiology lesson | 25(26%) | 27(28.1%) | 18(18.8%) | 18(18.8%) | 8(8.3%) |

Table 2. Mean scores of teaching components (N=96)

| Teaching components | Mean (SD) | Minimum | Maximum |
|---------------------|--------------|---------|---------|
| Learning Quality | 14.47 (3.8) | 4 | 20 |
| Teaching Method | 7.16 (2.46) | 2 | 10 |
| Content Quality | 12.53 (2.57) | 4 | 19 |
| Student Motivation | 6.85 (1.97) | 2 | 10 |
| Total | 41.03 (9.64) | 12 | 59 |

other lessons as well which is in line with the study by Anil et al. in Department of Physiology Government Medical College, and General Hospital, Akola, Maharashtra, in collaboration with department of medicine, GMC, Akola, India (2021) on 150 1st-year MBBS medical students that received endocrine physiology training in one group as combination of early clinical exposure by residents from medicine department in hospital settings and the faculty from the physiology department and a control group that taught only through conventional didactic lectures demonstrated that 67% of students expressed a desire and need for ECE implementation in teaching of basic science for each system (8). This is in parallel with the present study that 50% of students considered this teaching method effective in trying for better learning of endocrine and gastrointestinal physiology lessons which is in accordance with the study by Anil et al. that showed about 80% of students had increased the student's interest in learning basic sciences and their applications (8).The results of the present study also

indicated that 70.8% of students disagreed and completely disagreed with the difficulty of this teaching method to learn endocrine and gastrointestinal physiology and 61.4% of students agreed and completely agreed that this teaching method helped them to learn the endocrine and gastrointestinal physiology; that is in line with the study by Rafique in department of physiology of Saudi Arabia (2014) on 104 the second year MBBS class that 99% of students in this study responded that integrated approach makes easy learning and understanding (22).

A possible explanation of agreement of medical students with usefulness of the integration of clinical and basic sciences has been demonstrated in many studies (24, 25). The integration of basic and clinical sciences probably leads to better application of basic science principles in the appropriate clinical setting and hence, better retention of knowledge (26). Also, an integrated curriculum can boost the confidence of students in their ability to succeed in medical practice also, it may enhance the preparing of students for international standardized exams (27).

Furthermore, results indicated the mean score of overall students motivation was 6.85 ranging 2 to 10 and mean score of quality of teaching was 7.16 ranging 2 to 10 that both is medium-high degree. It is in linear with Montané et al.study (2023) (28) on 246 medical students in intermediate years in Trias i Pujol University Hospital (Barcelona, Catalonia, Spain). They completed a questionnaire including 21 items, divided into four sections (motivation, theory lectures, hospital internships, and research) that students motivation and quality of teaching was 6.15 and 7.1 ranging 1-9 and 1-10 respectively. The medium-high degree of students motivation and quality of teaching which was related to the

content of quality with mean score of 12.53 ranging 4 to 19 in our work is in agreement with Montané et al. study (2023)(28) on 246 medical students in intermediate years and in late years in Trias i Pujol University Hospital (Barcelona, Catalonia, Spain) that was 4.8 ranging 1-5. It could be attributed to reductions in content overload, fostering of interdisciplinary integration and promotion of early contact with clinical activities as learning scenarios and small-group discussions instead of formal lectures (29).

The mean score of learning quality in the present study was 14.47 ranging 4-20 which was in line with Surapaneni study (2024) (30) in Chennai, Tamil Nadu, India on first year students of Bachelor of Medicine and Bachelor of Surgery (MBBS) in two control group A (n=74) that received teaching with large-group lectures, and the intervention group B (n=74) that was tested with an innovative curriculum the Self-directed, Problem-oriented, Lifelong learning, Integrated Clinical case Exercise (SPLICE) modules designed to promote ECE, critical thinking, and contextual learning. Students found SPLICE sessions effective in early clinical exposure, promoting critical thinking, and facilitating active learning. There are challenges on ECE implementation and related views are that ECE cannot be a complete replacement for lectures and for every topic e.g., anatomy, therefore blended methods were suggested. Learning of basic sciences associated with clinical practice can improve student's motivation to learn and retention of knowledge because motivation is considered the most important factor for any teaching and learning methodology to stimulate and facilitate learning activities (because learning is an active process that needs to be motivated) also, for the design of curriculum, teaching methods, and evaluation process (31). This study had several limitations. One limitation was that in two classes there was one group as traditional teaching and the other group in a combination of clinical and basic sciences then compared two teaching methodologies to each

other; however, the present researchers were not able to implement this methodology. Another limitation was current study was done based on the students' viewpoints and the researchers could not assess the learning status of students to compare it with the traditional method. Another limitation of this study was the lack of clinical exposure of students in the hospital setting. It is recommended for future studies that one group considered as traditional teaching (only lecture method) and another group as integration teaching then compared two teaching methodologies with each other. Also, The design of the study should be such that the learning status of the students is also examined.

CONCLUSION

This study suggested that ECE approach besides lecture may provide more benefits than traditional teaching in endocrine and gastrointestinal physiology education; and it can be extended to other topics of physiology and basic sciences as well.

Ethical considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors. The present study was approved by the ethics committee of Birjand University of Medical Sciences (code IR.BUMS.REC.1402.267).

ACKNOWLEDGEMENT

The authors would like to thank the Vice Chancellor for the research and technology of Birjand University of Medical Sciences and all medical students who participated in this study.

Financial Support: None

Conflict of Interest: None

REFERENCES

1. Pusparajah P, Goh BH, Lee L-H, Law JWF, Tan LT-H, Letchumanan V, et al. Integrating the Basic and Clinical Sciences Throughout the Medical Curriculum: Contemplating the Why, When and How. *Progress in Drug Discovery & Biomedical Science*. 2022;5(1):1-17.
2. Alzerwi NAN. Flexner has fallen: Transitions in medical education system across time, a gradual return to pre-Flexnerian state (de-Flexnerization). *World J Clin Cases*. 2023;11(21):4966-74.
3. NuggedAlla MAA. Perception and significance of basic sciences for clinical studies. *International Journal of Human Anatomy*. 2018;1(2):26-32.
4. Alammary A. Blended learning models for introductory programming courses: A systematic review. *PLoS One*. 2019;14(9):e0221765.
5. Shah S, Meisenberg G. Opinions about teaching modalities: A comparison between faculty and students. *Education Research International*. 2012, 604052, 7 pages, 2012.. <https://doi.org/10.1155/2012/604052>.
6. Malik AS, Malik RH. Twelve tips for developing an integrated curriculum. *Med teach*. 2011;33(2):99-104.
7. Weston WW. Do we pay enough attention to science in medical education? *Can Med Educ J*. 2018;9(3):e109-e114.
8. Warkar AB, Asia AA. Introduction to early clinical exposure as learning tool in physiology. *Indian Journal of Physiology and Pharmacology*. 2021;64(Suppl 1):S62-S9.
8. Nabeiei P, Amini M, Ghanavati S, Marhamati S. Research priorities in medical education at Shiraz University of Medical Sciences: categories and subcategories in the Iranian context. *J Adv Med Educ Prof*. 2016;4(1):26-32.
9. Tayade MC, Latti RG. Effectiveness of early clinical exposure in medical education: Settings and scientific theories - Review. *J Educ Health Promot*. 2021;10:117.
10. Kulasegaram KM, Martimianakis MA, Mylopoulos M, Whitehead CR, Woods NN. Cognition before curriculum: rethinking the integration of basic science and clinical learning. *Acad Med*. 2013;88(10):1578-85.
11. Gul A, Khan RA, Yasmeen R, Ahsan NU. How Case Based Learning Promotes Deep Learning In Preclinical Years Of Medical Students? *J Ayub Med Coll Abbottabad*. 2020; 32(2):228-33.
12. Harden RM, Dent JA. *A Practical Guide for Medical Teachers*. 4th ed. London: Elsevier; 2013.
13. Wijnen-Meijer M, van den Broek S, Koens F, Ten Cate O. Vertical integration in medical education: the broader perspective. *BMC Med Educ*. 2020;20(1):509.
14. Abdollahyar A, Baniasadi H, Doustmohammadi MM, Sheikhbardsiri H, Yarmohammadian MH. Attitudes of Iranian Nurses Toward Spirituality and Spiritual Care. *J Christ Nurs*. 2019;36(1):E11-E16.
15. Sheikhbardsiri H, Khadempour G, Davarani ER, Tavan A, Amiri H, Sahebi A. Response capability of hospitals to an incident

- caused by mass gatherings in southeast Iran. *Injury*. 2022;53(5):1722-26.
16. Dornan T, Bundy C. What can experience add to early medical education? Consensus survey. *Bmj*. 2004;329(7470):834.
17. Walters MR. Case-stimulated learning within endocrine physiology lectures: an approach applicable to other disciplines. *Advances in physiology education*. 1999;276(6):S74.
18. Walters MR. Problem-based learning within endocrine physiology lectures. *Advances in Physiology Education*. 2001;25(4):225-7.
19. Vari RC, Borg KE, MCCleary VL, McCormack JT, Ruit KG, Sukalski KA, et al. Endocrine physiology in a patient-centered learning curriculum. *Advances in physiology education*. 2001;25(4):241-8.
20. Legan SJ. Multiple-format sessions for teaching endocrine physiology. *Advances in physiology education*. 2001;25(4):228-32.
21. Kim E, Barrett, Susan M, Barman, Scott Boitano, Jane F, Reckelhoff. *Ganong's medical physiology examination & board review*. International Edition ed: Mc Graw Hill education; 2018.
22. Rafique N. Importance of vertical integration in teaching and assessment of physiological concepts. *Journal of Taibah University Medical Sciences*. 2014;9(4):282-8.
23. Mattout SK, Shah BM, Khan MM, Mitwally NA, Al Aseri ZA, Yousef EM. Realistic simulation case scenario as a vertical integration teaching tool for medical students: A mixed methods study. *J Taibah Univ Med Sci*. 2023;18(6):1536-44.
24. Farzan B, Anbari K, Rezaiean J, Shirkhani S. The necessity of implantation of horizontal integration plan of basic sciences and university academic staff and students, satisfaction. *yafte*. 2015;17(3).
25. Willey JM, Lim YS, Kwiatkowski T. Modeling integration: co-teaching basic and clinical sciences medicine in the classroom. *Advances in Medical Education and Practice*. 2018:739-51.
26. Dahle L, Brynhildsen J, Fallsberg MB, Rundquist I, Hammar M. Pros and cons of vertical integration between clinical medicine and basic science within a problem-based undergraduate medical curriculum: examples and experiences from Linköping, Sweden. *Med teach*. 2002;24(3):280-5.
27. Thompson AR, Braun MW, O'Loughlin VD. A comparison of student performance on discipline-specific versus integrated exams in a medical school course. *Advances in Physiology Education*. 2013;37(4):370-6.
28. Montané E, Vilaplana C, Riera J, Pujol M, Méndez M, Mas A, Vara A, Parés D. Medical Students' Opinion of Their Learning Process. *Medical Science Educator*. 2023;33(5):1183-90.
29. Del-Ben CM, Shuhama R, Costa MJ, Troncon LE. Effect of changes to the formal curriculum on medical students' motivation towards learning: a prospective cohort study. *Sao Paulo Medical Journal*. 2019;137:112-8.
30. Surapaneni KM. Innovative Self-directed, Problem-oriented, Lifelong learning, Integrated Clinical case Exercise (SPLICE) modules promote critical thinking skills, early clinical exposure, and contextual learning among first professional-year medical students. *Advances in Physiology Education*. 2024 ;48(1):69-79.
31. Tayade MC, Giri PA, Latti RG. Effectiveness of early clinical exposure in improving attitude and professional skills of medical students in current Indian medical education set up. *Journal of Family Medicine and Primary Care*. 2021;10(2):681.