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The effect of integration of basic and clinical aspects of a specific topic in a parasitology course on medical students learning: A randomized controlled trial

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Abstract:

BACKGROUND AND AIM: Parasitology course is one of the basic science courses in the educational curriculum for medical students. Since the integration of basic and clinical sciences has helped students better understand the basic science course content, the aim of the present study was to determine the effect of integration of basic and clinical aspects of a specific topic in a parasitology course on medical students learning.

MATERIALS AND METHODS: A randomized controlled trial was conducted on 110 undergraduate fifth-semester medical students from April to July 2018. The students were randomly divided into two groups, based on student identification number: Intervention and control groups. The topic selected for this study from the parasitology course was "cutaneous leishmaniasis." At the beginning of the program, a dermatologist presented the clinical aspects of the topic to the intervention group. Then, a parasitologist delivered a traditional lecture about the basic aspects of the topic to both groups. The students' scores on questions related to cutaneous leishmaniasis in the final exam were used as a measure of learning and teaching outcomes. A questionnaire that consisted of seven items and three open-ended questions was used based on the objectives of the randomized controlled trial. Statistical analysis was performed by SPSS software.

RESULTS: Based on the result of the final examination, there was no significant difference in the learning rate of students between the intervention and control groups ($P \geq 0.05$). According to students' comments, the teaching of clinical science alongside basic science increased the importance of the topic and the students' interest in basic science. Most students agreed that this method prepares them for their clinical years.

CONCLUSION: Many medical students believe that the content of many basic science courses are forgotten in the future. Therefore, basic science education alongside clinical science presentations are suggested.

Keywords:

Curriculum, cutaneous, integration, leishmaniasis, medical, students

Introduction

The conventional medical education curriculum has been divided into basic and clinical sciences for medical students all around the world. Basic science is taught in the early years, and clinical science is taught in the setting of educational hospitals in later years. During the clinical phase, most medical students forget what they had

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learned during their basic science education.[1] In the past few years, the integration of basic and clinical sciences has occurred in the medical education curriculum in some universities.[2,3] An integrated curriculum was defined by Shoemaker[4] as "education that is organized in such a way that it cuts across subject-matter lines, bringing together various aspects of the curriculum into a meaningful association to focus upon broad areas of study." Horizontal integration and vertical integration are the two main types of integration in medical education. In horizontal integration, the various disciplines are taught concurrently, such as the teaching of anatomy, physiology, and biochemistry of the respiratory system as the basic science education alongside the learning of the normal and abnormal structures and functions of the respiratory system in the clinical science setting. In vertical integration, basic and clinical sciences are combined, such that there is an early introduction of clinical science education alongside basic science principles.[1] The objectives of integration of basic science with clinical science are to increase the efficiency of medical training, promote more in-depth learning of basic science, and facilitate the socialization of students into the medical profession.[5-7] Several studies have been undertaken regarding the integration of basic and clinical sciences and its effect on education.[2,8-15] Integration of basic and clinical science courses in U. S. pharmacy programs suggested variations in the design and implementation of integrated courses among U. S. pharmacy programs.[2] The integration of educational programs in physiopathology courses at Mashhad University of Medical Sciences indicated that integration improves the level of learning in students.[8] A study was done to elucidate the interest of dental students at the University of Texas health science center at Houston, school of dentistry about the integrated curriculum and identify challenges to integration, the results showed that all students agreed about the usefulness of the integration of clinical and basic sciences.[12] Mishra *et al*.[14] evaluated the perceptions of students on a vertical integrated teaching session, and their results showed that students appreciated and enjoyed this new method of teaching. Vertical integration of head, neck and special senses module in undergraduate medical curriculum improved the effectiveness of basic sciences lectures and clinical skills sessions.[15]

The medical parasitology course is one of the basic science courses in the educational curriculum for medical students in the fifth semester at Shiraz University of Medical Sciences (SUMS). Currently, basic and clinical parasitology are taught separately. The basic parasitology course includes theoretical and practical topics and is taught by parasitologists. The teaching of theoretical parasitology is focused on the taxonomy of parasites, morphology, life cycle, epidemiology, clinical manifestations, diagnosis, treatment, control, and prevention of parasitic diseases using the lecture method. The practical work is also performed in a laboratory using a microscope with a set of fixed parasitological slides. The course final exam is designed as a multiple-choice test along with a microscopic slide exam. The clinical part of the education is carried out in the educational hospitals of the university in later years. During their clinical rotations, many medical students believe that they have forgotten most of their basic science course materials. In many courses, the integration of basic and clinical sciences has helped students learn the basic science course content better.

Considering the importance of the integration of basic and clinical sciences, and since the integration program has not occurred in the medical parasitology education curriculum in SUMS, the objective of this current study is to determine the effect of integration of basic and clinical aspects of a specific topic in a parasitology course in one major university, on medical student learning.

Materials and Methods

Study design and participants

This randomized controlled trial was conducted on 110 undergraduate fifth-semester medical students in the same class from April to July 2018 at the school of medicine, SUMS, Shiraz, Iran. The students were randomly divided into two groups, each group containing 55 medical students, based on their student identification number: Intervention and control groups. The topic of the parasitology course used for this study was "cutaneous leishmaniasis." The intervention was the teaching of the clinical aspects of cutaneous leishmaniasis, including clinical manifestation, diagnosis and treatment, which taught by a dermatologist. For the ethical purpose, all students were assured that they would receive the required teaching after the intervention and measurement, and the study aim was clarified to the students by the researcher. The design of the study, including ethical aspects, was approved by the ethics committee of the SUMS, Iran (code: IR.SUMS.REC.1398.764).

Intervention group

The intervention group included 55 students who received both clinical and basic sciences education on the topic. At the beginning of the randomized controlled trial, a dermatologist presented the clinical aspects of cutaneous leishmaniasis as intervention, which were not a part of the parasitology curriculum. The clinical features of the different types of cutaneous leishmaniasis, the diagnosis, and various treatment modalities of the disease were presented in a traditional type lecture for 1 h. After a break, according to the parasitology curriculum,

a parasitologist delivered a 2-hour lecture about the basic science aspects of cutaneous leishmaniasis. This lecture included epidemiology, classification, morphology, clinical symptoms, diagnosis, treatment, control, and prevention. Thereafter, students observed *Leishmania* parasites using the microscope and fixed microscope slide in the laboratory for 2 h.

Control group

The control group included 55 students who were only trained in the basic science aspects of cutaneous leishmaniasis and observed *Leishmania* parasites in the laboratory. The clinical aspects of the disease were not presented by a dermatologist, therefore, their course time was only for 4 h.

Evaluation methods

Before the beginning of the study, the researchers designed a questionnaire that consisted of seven items-better understanding of basic science concepts, encouragement to study further, stimulation of interest for the lesson, learning the clinical application of the lesson, introduction of the importance of the topic, agreement with clinical science education before basic science education, evaluation of the program-with a five-point Likert scale ranging from very weak to very good and three open-ended questions. The items measured the medical students' viewpoints about the effect of integration of basic and clinical sciences in the parasitology course. The open-ended questions asked about the strengths and weaknesses of the objectives of the study. The validity of the questionnaire was determined by medical education experts. Content validity ratio (CVR) was calculated based on the responses to the necessity of questions. The experts scored the items based on a 3-point Likert scale (essential, useful but not essential, not essential). CVR was calculated through the formula (CVR = [nE-N/2]/[N/2]). According to Lawshe's table, the CVR higher than 0.62 indicated the necessity of the item. Content validity index (CVI) was assessed by the same experts who scored items of the questionnaire based on their relevancy, clarity, and simplicity. Items with a CVI higher than 0.79 were considered suitable. The reliability was confirmed after a pilot study ($r = 0.80$). The questionnaire was distributed among the students in the intervention group after the end of the program and were filled out. The students' scores about cutaneous leishmaniasis in the final exam were used as a measure of learning and teaching outcomes. A diagram of the study design is shown in Figure 1.

Statistical analysis

Statistical analysis was performed using SPSS software version 18 (SPSS, Chicago, IL, USA). The data were analyzed using descriptive statistical methods (mean and standard deviation). The *t*-test was done to compare the mean scores of the intervention group with the control group. A value less than 0.05 was considered statistically significant.

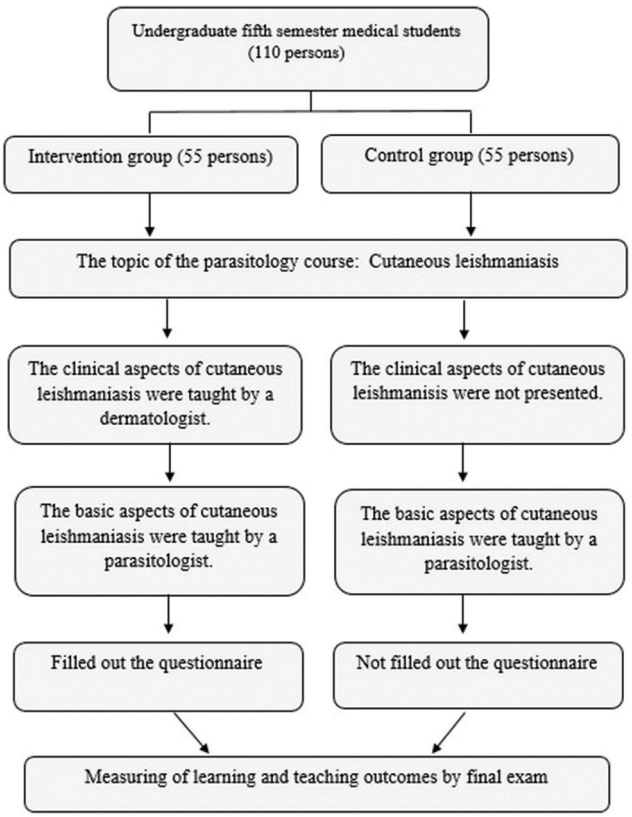

Figure 1: Diagram of the study design

Results

Based on the results of the final exam, the mean scores of the intervention group (16.13 ± 3.31) were higher than the mean scores of the control group (15.08 ± 3.17); however, statistical analysis indicated that there was no significant difference in the mean scores between the two groups ($P = 0.128$).

The students in the intervention group filled out the questionnaire and the majority of them stated that the integration of basic and clinical aspects helped them learn the cutaneous leishmaniasis topic better. The results of the questionnaire questions (seven items) are shown in Figure 2.

According to students' comments, the teaching of clinical science alongside basic science increased the importance of the topic and the students' interest in basic science. However, the negative points of the program were their unfamiliarity with clinical terms used by the dermatologist and the repetition of basic parasitological content during the basic science presentation after

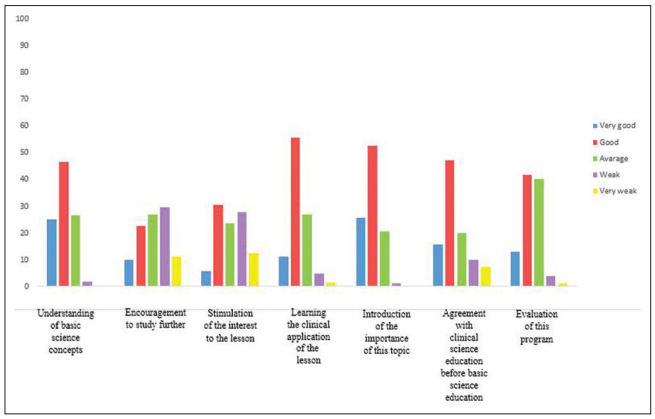

Figure 2: Medical students' viewpoints about the effect of integration of basic and clinical sciences of the parasitology course

attending the clinical lecture. However, most students believed that this method of teaching was innovative and the addition of clinical aspects just before the basic science presentation was an asset. A high percentage of students agreed that the integration of basic and clinical sciences in this parasitology course was a useful initiative to prepare them for their clinical years.

Discussion

In medical education, the relationship between theoretical and practical knowledge is most important aspect of learning and the effectiveness of the integration program depended on its mode of implementation at the right time and place in the curriculum.[16] Many believe that teaching of basic science should be placed in the clinical context, and early exposure to clinical science teaching helps to increase the students' understanding and interest in basic science.[2,3] The integration of basic and clinical sciences is a popular program in universities of medical sciences all around the world.[17] The integration program, including horizontal integration of basic science courses, and 36 months of clinical rotations was started at SUMS in 2009.[18,19] Rooholamini *et al*.[10] reported that the integrated basic science course for undergraduate medical students in Shiraz medical school was at a desirable level, and improvement of some sections was necessary. However, the medical parasitology course is still taught in the traditional lecture method and includes theoretical and practical topics.

This study aimed to investigate the effect of the integration of basic and clinical aspects of a topic in the parasitology course on medical students learning. In the current study, there was no significant difference between the learning rates of students in the intervention group as compared to the control group. However, the majority of the students reported that the integration of basic and clinical sciences in this parasitology course led to better learning of the topic. These results are similar to some studies about the application of integration programs on student learning.[8,11,20-23] Bahari *et al*.[8] showed that the level of learning in students improved by the integration of educational programs in physiopathology courses. Chaudhary *et al*.[11] compared the effect of integrated extended basic science (EBS) learning with that of clinically focused instruction on an initial assessment of diagnosis in medical psychiatry, and the results showed that the integration of EBS could enhance later learning of new related concepts. Forouzan *et al*.[20] evaluated the opinions and viewpoints of university professors and medical students about the necessity of application of a horizontal integration plan of basic sciences in Lorestan University of Medical Sciences, and the results showed that the integration of basic and clinical sciences was necessary to facilitate learning and for a better understanding of educational material and promoting connection between theoretical and practical courses. Dehghan *et al*.[21] used the early clinical exposure initiative in teaching renal physiology to 2nd-year medical students in Shiraz medical school, and based on the results, the students reported that this program was useful to strengthen their learning. The integration between pathology teaching and clinical teaching showed that this method was satisfactory and the faculties opined that didactic lectures with the addition of problem-based learning will make the subject more interactive.[22] Kolahdouzan *et al*.[23] determined the effect of the case-based teaching method in comparison with the lecture method on students' learning and satisfaction at the internship of Department of General Surgery, Isfahan University of Medical Sciences and the students' satisfaction with case-based learning method was higher than that of lecture method. Dulloo *et al*.[9] investigated the impact of horizontal and vertical integration on learning and perception in medical students and their result showed statistical significance for learning outcome by integrated teaching. The findings of our study regarding the effect of integration of basic and clinical aspects of parasitology course on medical students learning were consistent with the results of the study done by Dulloo *et al*.,[9] where that integration program gave the students a better understanding of the topic.

The medical students' viewpoints about the integration program in our parasitology course showed that clinical science education alongside basic science education encouraged the students to better understand the application of basic science concepts. The results of a study about the integration of basic and clinical sciences in an oral radiology education program for dental students revealed that the teaching of basic science integrated with clinical features was more effective

than teaching basic science aspects alone and was helpful for diagnostic accuracy.[24] The integration of the evidence-based medicine (EBM) curriculum was tested for the 1st year medical students by Kumaravel *et al*.[13] and it was shown that the early introduction to EBM principles to medical students before clinical exposure can increase their knowledge and skills.

In many studies, participants have agreed with the usefulness of the integration of clinical and basic sciences.[12,20,25] The integration of basic and clinical sciences showed that the students understood the connection between basic and clinical sciences better when the content was co-taught.[25,26]

There are several limitations to this current study. One limitation of this study was that the duration of the program was short, so the effect of integration of a topic (cutaneous leishmaniasis) from a parasitology course could not be extrapolated to the whole. Another limitation of our study was that the students had no clinical exposure in the hospital. Similar to our study, the results of the other study reported that although early clinical exposure program in learning is useful, more encounter with patients and more hospital teaching is necessary.[21] But, the strength of the present study was that this method of teaching was innovative. In many integration studies, basic science contents are taught initially, and after that, the clinical aspects of the subject are presented to the students; however, in this study, clinical science aspects were taught before the basic science presentation of the topic.

Conclusion

Many medical students believe that basic science courses are forgotten in their later years of a medical study. Therefore, basic science education alongside clinical science instruction and clinical exposure in educational hospitals can help to a more in-depth learning of basic science. In future studies, the integration of basic and clinical aspects of a full course of parasitology should be considered and early encounter with patients and hospital teaching should be included.

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Conflicts of interest

There are no conflicts of interest.

References

1. Harden RM, Dent JA. A Practical Guide for Medical Teachers. 4th ed. London: Elsevier; 2013.
2. Islam MA, Talukder RM, Taheri R, Blanchard N. Integration of basic and clinical sciences courses in U.S. PharmD programs. Am J Pharm Educ 2016;80:166.
3. Wilkins KM, Moore D, Rohrbaugh RM, Briscoe GW. Integration of basic and clinical science in the psychiatry clerkship. Acad Psychiatry 2017;41:369-72.
4. Shoemaker BJ. Integrative education: A curriculum for the twenty-first century. OSSC Bull 1989;33:1-46.
5. Spencer AL, Brosenitsch T, Levine AS, Kanter SL. Back to the basic sciences: An innovative approach to teaching senior medical students how best to integrate basic science and clinical medicine. Acad Med 2008;83:662-9.
6. Dahle LO, Brynhildsen J, Behrbohm Fallsberg M, 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;24:280-5.
7. Dornan T, Bundy C. What can experience add to early medical education? Consensus survey. BMJ 2004;329:834.
8. Bahari A, Puramin R, Chobdar N. The integration of educational programs in graduate studies of physiopathology from semester to course in Mashhad University of Medical Sciences. Horizon Med Edu Dev 2016;7:29-32.
9. Dulloo P, Vedi N, Gandotra A. Impact of horizontal and vertical integration: Learning and perception in first-year medical students. Natl J Physiol Pharm Pharmacol 2017;7:1170-6.
10. Rooholamini A, Amini M, Bazrafkan L, Dehghani MR, Esmaeilzadeh Z, Nabeiei P, *et al*. Program evaluation of an integrated basic science medical curriculum in shiraz medical school, Using CIPP evaluation model. J Adv Med Educ Prof 2017;5:148-54.
11. Chaudhary ZK, Mylopoulos M, Barnett R, Sockalingam S, Hawkins M, O'Brien JD, *et al*. Reconsidering basic: Integrating social and behavioral sciences to support learning. Acad Med 2019;94:S73-8.
12. van der Hoeven D, Zhu L, Busaidy K, Quock RL, Holland JN, van der Hoeven R. Integration of basic and clinical sciences: Student perceptions. Med Sci Edu 2020;30:243-52.
13. Kumaravel B, Jenkins H, Chepkin S, Kirisnathas S, Hearn J, Stocker CJ, *et al*. A prospective study evaluating the integration of a multifaceted evidence-based medicine curriculum into early years in an undergraduate medical school. BMC Med Educ 2020;20:278.
14. Mishra AK, Mohandas R, Mani M. Integration of different disciplines in medicine: A vertical integrated teaching session for undergraduate medical students. J Adv Med Educ Prof 2020;8:172-7.
15. Arain SA, Kumar S, Yaqinuddin A, Meo SA. Vertical integration of head, neck, and special senses module in undergraduate medical curriculum. Adv Physiol Educ 2020;44:344-9.
16. Mathur M, Mathur N, Saiyad S. Integrated teaching in medical education: The novel approach. J Res Med Edu Ethic 2019;9:165-73.
17. Brauer DG, Ferguson KJ. The integrated curriculum in medical education: AMEE Guide No. 96. Med Teach 2015;37:312-22.
18. Nasr K. Shiraz university school of medicine: Its foundation and development. Arch Iran Med 2009;12:87-92.
19. Amini M, Kojuri J, Mahbudi A, Lotfi F, Seghatoleslam A, Karimian Z, *et al*. Implementation and evolution of the horizontal integration at shiraz medical school. J Adv Med Educ Prof 2013;1:21-7.
20. Forouzan B, Anbari KH, Rezaeian J, Shirkhani S, Gholami MR. The necessity of implantation of horizontal integration plan of basic

sciences and university academic staff and students, satisfaction. Yafteh 2015;17:5-14.
21. Dehghan A, Amini M, Sagheb MM, Shidmoosavi SM, Nabeiei P. Early clinical exposure program in learning renal physiology. J Adv Med Educ Prof 2017;5:172-6.
22. Khonglah Y, Raphael V, Mishra J, Marbaniang E, Chowdhury Z, Dey B. Relooking the curriculum and assessment in undergraduate pathology. J Educ Health Promot 2019;8:116.
23. Kolahdouzan M, Mahmoudieh M, Rasti M, Omid A, Rostami A, Yamani N. The effect of case-based teaching and flipped classroom methods in comparison with lecture method on learning and satisfaction of internship students in surgery. J Educ Health Promot 2020;9:256.
24. Baghdady MT, Carnahan H, Lam EW, Woods NN. Integration of basic sciences and clinical sciences in oral radiology education for dental students. J Dent Educ 2013;77:757-63.
25. Willey JM, Lim YS, Kwiatkowski T. Modeling integration: Co-teaching basic and clinical sciences medicine in the classroom. Adv Med Educ Pract 2018;9:739-51.
26. Wijnen-Meijer M, van den Broek S, Koens F, Ten Cate O. Vertical integration in medical education: The broader perspective. BMC Med Educ 2020;20:509.