

## Effect of Integrated Teaching on Students' Learning

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### Abstract

**Background:** Currently medical education in Iran consists of basic sciences, physiopathology and clinical stages. Medical students learn them separately and often are confused that how basic sciences materials would be helpful for the patient's diagnosis and treatment. Integration of various related subjects during medical education is one the proposed strategy to overcome this problem.

**Objectives:** The present study was conducted to assess the effect of an integrated teaching approach on medical students' attitudes and knowledge about infection diseases.

**Methods:** This quasi-experimental study was conducted in the infectious disease ward of Valiae-asr Hospital affiliated to Birjand University of Medical of Sciences, Birjand, Iran. A total of 60 medical students (stagers) were randomly selected and assigned to the control and intervention groups. The two groups were matched based on their grade point average (GPA), age, and gender. An integrated teaching approach was adopted in the intervention group by four epidemiology, microbiology, infectious diseases, and pharmacology professors. The students' knowledge was assessed by a written exam, and their attitude was evaluated using a questionnaire. Data was analyzed by SPSS version 16 and using paired and independent samples t-test.

**Results:** The analyses showed that 52% of the participants were male. The mean scores in the cognitive and emotional domains were not correlated with students' gender, and they were not significantly different before ( $p= 0.12$ ) and after ( $p= 0.25$ ) the intervention. The students' final learning scores were significantly higher in the intervention group than that of the control group ( $16.16\pm 1.17$  vs  $14.12\pm 1.73$ ;  $p=0.001$ ).

**Conclusion:** The integration of basic and clinical subjects helps students to better understand the physiopathology of diseases and enhances their satisfaction.

**Keywords:** Infectious Diseases, Integrated Teaching, Learning, Medical Students

### Background

The medical education system in Iran consists of three separate major levels, including basic sciences, physiopathology, and clinical stages (1, 2). The basic sciences level is taught in the first part of the curriculum and takes about two to three years. Students learn basic sciences and the necessary skills before entering the clinical stage (2). The courses in the level of the basic sciences are related to the human body, such as Physiology, Epidemiology, Biochemistry, Microbiology, Immunology, etc. After completing the stage of the basic science,

students enter the physiopathology level, which generally takes one year (3). At this level, they learn the signs, symptoms, diagnoses, and treatments of diseases and the factors influencing disorders. The Pharmacology course is also presented at this stage (3). The clinical-stage includes two parts, including the apprenticeship (stagership) and internship levels. In the stagership period, which takes two years, medical students gain a clinical and pathological understanding of diseases and acquire the necessary skills to treat patients under the supervision of clinical teachers. Students also learn practical skills, including

clinical examination, diagnostic techniques, and treatment methods. The clinical internship period usually takes 18 months and includes skills training and clinical decision-making independent from professors' supervision. At this level, students start disease diagnosis and treatment (3).

The teaching processes for medical courses are traditionally separate. Basic sciences are instructed in the first 2-3 years of the curriculum, whereas the clinical subjects are usually presented in the last part of the curriculum. Medical students are mostly confused in the early years of their studies. One of the most important and controversial questions they raise is that how much theoretical contents from basic sciences would be useful for disease diagnosis and treatment (2). Evidence shows that there is no logical relationship between the basic and clinical subjects, and the inappropriate method and time for teaching has made the problem even more complicated. The integration of basic and clinical courses is a strategy suggested by the Ministry of Health and Medical Education in Iran (3).

Special attention was paid to designing interdisciplinary curriculum programs, also called the integrated teaching/learning approach, from 1930 to 1980, which was the golden time for curriculum development (4). The purpose of curriculum integration is to link and to mix the contents from different disciplines to meet the basic educational needs of learners and improve their level of thinking (5).

Integrated instruction is defined as a kind of teaching approach within which students at the same time analyze a variety of knowledge related to a certain scientific course but from different dimensions (6). Integration includes a set of programmed learning experiences that not only provide a collection of common information and knowledge for learners but also enables them to discover new relationships among different scientific disciplines for better learning of a subject as a whole (7). Integration in the teaching process occurs in different formats, such as single-threaded, multi-disciplinary, and inter-disciplinary approaches. In the single-threaded approach, learning in one field is simultaneously improved by learning another field. In multi-disciplinary integration, an educational subject is taught by teaching several related subjects. However, in interdisciplinary integration, the merging of the teaching process occurs by mixing two courses and establishment of a new educational course (8). The integrated teaching approach offers numerous advantages, including interdisciplinary relationship, a more efficient teaching/learning process, improvement of the level of education, translating from knowledge level to practice and problem-solving level, increasing students' motivation, and finally, enhancing the cooperation of professors in a multi-disciplinary academic environment (8, 9).

It is believed that the integration of basic and clinical sciences provides opportunities to improve physicians' competencies and prepare them to adapt to evolving technologies and patient expectations. The attitude and working habits of learners have been improved, and their team work attitude has substantially increased in the

integrated method (1). This type of integration in medical education also enhances the application of basic sciences' principles to improve students' critical thinking, resulting in efficient clinical decision making (9).

### Objectives

Considering the fact that several studies emphasize the superiority of the integrated teaching method and differences in learning and teaching cultures, the objective of the present study was to determine the effectiveness of integrated teaching method in the cognitive and emotional domains among the medical students attending the theoretical course of Infectious Diseases at Birjand University of Medical Sciences. We also sought to compare the impacts of integrated and traditional teaching methods on students' learning scores.

### Methods

This semi-experimental study was carried out in a course on infectious diseases, including the infectious disorders caused by several bacteria, including *Mycobacterium tuberculosis*, *Homophiles influenza*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Streptococcus pneumonia*. The course was offered in the infectious diseases ward at Vali-e-Asr Hospital affiliated to Birjand University of Medical Sciences, Birjand, Iran. All participants were randomly divided into control and intervention groups based on their age, gender, and the GPA score of basic sciences courses.

The participants were all medical students who were at the stager stage (fourth year) and had registered for participation in the Infectious Diseases course in the academic year 2017-18. Medical students who were not interested in participation in the study or were absent for more than one session were excluded. Finally, 60 medical students participated in the study.

Initially, a pre-test was taken to evaluate the primary knowledge of both control and intervention groups regarding infectious diseases. The possible marks ranged from 0 to 20. Using a researcher-made questionnaire, we also asked for the students' opinions regarding the cognitive and emotional effects of the integration of basic and clinical courses of infectious diseases as a new teaching method.

Then, the control group, including 30 medical students, attended an infectious diseases course on the above-mentioned subjects during four sessions (8 hours) by a professor who was a specialist in infectious diseases. At the end of the course, a summative evaluation (post-test) was performed as the final exam. Using a questionnaire, we also obtained the students' opinions regarding the effect of this method on their cognitive and emotional functions.

In the next semester, the other 30 medical students from the same level (experimental group) participated in an integrated teaching/learning approach, including four sessions (8 hours) following a pre-test. Using a questionnaire, we also obtained students' opinions regarding the effect of this method on their cognitive and

emotional functions. A collection of faculty members from the Epidemiology, Microbiology, Infectious Diseases, and Pharmacology departments presented their teaching contents in an integrated method at the same time and the same location as the traditional teaching method.

Before the beginning of the course, the objectives for the integrated teaching method were explained to the students, and their informed consent to attend the study was obtained. The course syllabi were identical in both teaching methods. Therefore, other professors agreed to cover only the same materials which were formerly taught by the professor who was a specialist in infectious diseases. While all the professors were present during the class, the integrated method was performed as follows: The first 10 minutes of each session were devoted to evaluating the students' learning and drawing their attention to remarkable and more important points in each subject. Then, the microbiology professor explained for 15 minutes the structure of the microorganism, virulence factors, the organism characteristics in culture and microscopy, and the general method of pathological diagnosis. Then, for 15 minutes, the epidemiology professor presented a detailed epidemiology of the disease in the world, Iran and South Khorasan. After that, 10 minutes was devoted to questions and answering them as well as discussion related to these two parts. Afterward, the infectious diseases professor talked about the related diseases, symptoms of each disease, differential diagnoses, and pathological and radiographic diagnoses for 35 minutes. Finally, for 15 minutes, the pharmacology professor explained the treatment, selected antibiotics, and their application in the related infections, treatment challenges, interactions, and side effects. The last 10 minutes were assigned to asking questions, answering, and general discussion by the students in the presence of the four professors. At the end of the 4<sup>th</sup> session, using the same checklist, the students' points of view were recorded in two levels. Summative evaluation was also conducted by performing a post-test similar to the pre-test. Also, the students' points of view were obtained with the same questionnaire used for the control group.

Data was entered into SPSS (v.16), and learning outcomes were assessed in both groups by comparing their mean scores before and after the teaching procedure with each other using *t*-test. In the intervention group, the students' points of view were also analyzed in the cognitive and emotional domains using paired *t*-test. A *P*-value of less than 0.05 was considered significant.

The present study was designed and conducted as an educational scholarship project approved by the center for the development of medical education (EDC) at Birjand University of Medical Sciences, and the need for its ethics approval was waived by the Vice-Chancellor

for Education in Birjand University of Medical Sciences (Certificate No. 1213119/12). Before starting the project, the study objectives were explained to all the participants. Those who agreed and signed the written informed consent were enrolled. The participants were informed that participation was voluntary and they could leave the study at any time.

## Results

The mean age of the participants was  $19.49 \pm 1.51$  years, and 52% of them were male. There was no significant difference between the two groups regarding their demographic information. The mean scores of the students' points of views in the cognitive domain before and after the intervention were  $24 \pm 1.38$  and  $25.8 \pm 1.36$  out of 45, respectively. Although the students' mean score in the cognitive domain was higher after the teaching intervention, but this difference was not significant ( $P=0.12$ ). The same trend in the emotional domain was observed. The mean scores of the emotional domain before and after the procedure were  $23.2 \pm 1.42$  and  $24.6 \pm 1.26$  out of the total of 45, respectively ( $P=0.25$ ).

Comparison of mean scores in cognitive and emotional domains in the two genders revealed no significant differences. Indeed, the mean score for the female and male students in the cognitive domain were  $24.6 \pm 8.3$  and  $27.1 \pm 4.8$  ( $P=0.36$ ), respectively. In the emotional domain, these values were  $22.9 \pm 7.7$  for female and  $26.5 \pm 3.8$  for male students ( $P=0.16$ ). Our findings also showed that the students' final marks (mean) in the intervention group was  $16.16 \pm 0.23$  out of 20, whereas this value for the control group was  $14.12 \pm 0.35$ . Statistical analysis of the data revealed that the integrated multidisciplinary method was significantly more effective in promoting learning compared to the traditional teaching method ( $P < 0.001$ ; Table 1).

## Discussion

This study examined the effect of integrated teaching on medical students' attitudes and knowledge about infectious diseases using a questionnaire. There was no significant difference between the two groups in terms of their attitudes towards the teaching methods. Although the mean scores for both cognitive and emotional domains increased after the intervention, the differences were not significant. This could be due to the small sample size, which is one of the limitations of our study and needs further investigation with larger sample sizes. Also, no association was found between gender and scores neither in cognitive nor in emotional domains. Although the mean score in the cognitive domain for male students was higher than the female students' mean score, this difference was not significant.

**Table 1.** Comparison of summative marks (mean) between the intervention and control groups

Procedure	N	Mean	SE	P
Integrated	30	1.17	0.23	0.001
Traditional	30	1.73	0.35	

Also, the mean score of male students in the emotional domain was higher than female students' mean score; however, this difference was not statistically significant. These findings were consistent with the results of other studies.

In a study by Rosse et al. on teaching of Anatomy course, the results showed that students showed better progress by the integrative approach in comparison to the traditional method not only in the cognitive dimension but also in the social and emotional domains (10). Another study conducted in three medical schools in Holland to compare the impact of different educational methods on preclinical (the second-fourth years) and clinical students (fifth-sixth years), it was shown that students who were taught by the integrated method had a higher accuracy in clinical diagnosis in comparison with other students who were instructed by two other methods, such as traditional and problem solving (11). In another study conducted by Marreez in 2013, two groups of junior medical students participated, and the effect of the integrated teaching method was assessed on their attitudes and performance. They reported that the mean score for students' attitudes significantly increased due to the integrative teaching method. Students' attitude scores toward importance factors like the first impression with patient, general information for diagnosis and treatment procedure, and disease diagnosis were all significantly higher after integrated teaching (12).

Our study presented that summative marks for students' knowledge in the integrated method were significantly higher than those in the traditional one. This finding signifies the fact that the implementation of the interdisciplinary, integrated method for teaching the Infectious Diseases course had a remarkable positive impact and improved students' learning. This finding is consistent with the results of other studies. In an interventional study in the form of pre- and post-test by Vyas in 2011, 45 sophomore medical students participated in a Gastrointestinal course in the first year of the medical program. It included early clinical exposure, problem-based learning, small group laboratory work, and lectures. The evaluation of the program was formative with PBL sessions and summative using Knowledge exam and PBL. Students reported that their attitude towards the quality and efficacy of medical training increased by 81% after the implementation of the program. A positive feedback was received from the students and faculty members on the benefits. The students suggested that integrated teaching is a necessity for their learning and could be applied for other courses in the curriculum, as well (13).

Brauer et al. conducted a study aimed at evaluating the integration of medical subjects, such as Physiology, Anatomy, and Biochemistry in a Gastrointestinal Diseases course. The period of integration was three weeks each year. Sixty students participated in the study in each year, and their total period of education was three years. The teaching method included lecture, group discussion, and patients' clinical examination. The students were divided

into small groups consisting of six individuals. The professors were selected from Biochemistry, Physiology, and Anatomy departments. The procedure was carried out by a professor in each subject, and at the end of the three weeks, the students were assessed. The students believed that this approach could not only increase the cooperation between the basic and clinical departments but also it could motivate them to use their basic knowledge in the clinical stage. Eighty percent of the students reported that this teaching method could improve their scientific learning and skills in medicine (14).

In a survey of physicians and undergraduate students regarding the simultaneous teaching of basic and clinical sciences, they reported that this approach helped them to better understand their responsibilities as a physician in the society. They also emphasized the importance of cooperation among health systems in the treatment of patients. Regarding the cognition domain, the students reported that they better understood the diseases, and it also provided a powerful clinical information network in their minds and resulted in better disease diagnosis. In the behavioral domain, this integrated teaching method provided them an atmosphere to feel that they belong to the society and changed their attitudes and behaviors to have a better judgment about diseases. This method also helped them to achieve the skills needed for better communication and their improved social relationship with patients (15).

To improve the quality of teaching in modern medical education, various strategies have been taken into consideration as the basis for the integration of basic and clinical sciences in the curriculum of medicine. The SPECES teaching strategy proposed by Harden (16) is the major strategy, which consists of six items, as shown in Table 2.

The integrative approach is an important teaching method that aims to establish a relationship among academic subjects. One of the integration types is the vertical integration for the basic and clinical subjects. Recently, there has been a global desire for early clinical exposure (ECE) in the initial years of educational programs in medical training systems. The advantages of the vertical integration and ECE include students becoming more motivated to learn deeply, better understand the basic and clinical sciences, and more appropriately apply their knowledge for better clinical reasoning (17).

Kalpna reported that the integrated teaching method in medical education promoted learning by 61.5%, enhanced treatment performance by 70%, and improved students' attitude towards this teaching method by 67%. However, these figures for the traditional teaching method for the basic sciences and clinical stages were only 27%, 37% and 20%, respectively. The average of their marks was also increased significantly in the integrated method when compared with the other methods (18).

In a study conducted by Brumpton in 2013 to evaluate the opinions of medical students regarding an integrative teaching program, 125 fifth-semester students were

selected. Ninety percent of the students believed that the integrated teaching method helped them to improve their knowledge, skills, and scientific reasoning. Eighty-two percent of them also believed that the integrated teaching approach enhanced their abilities in clinical examination. Fifty-two percent of the students preferred horizontal integration to vertical integration. Medical education is constantly evolving and more than half of the schools in the United States change their curriculum annually through vertical and horizontal ways of integration (19). A study conducted by Zolfaghari et al. to develop a concept mapping strategy for integrating the basic and clinical sciences for Nursing and Midwifery students showed an increase in students' learning and participation. This study can be expanded to integrate clinical and basic training in other medical education programs (20).

### Strengths and limitations

We engaged with a main limitation in this study and introduced a teaching method. To apply this method, it was necessary to coordinate the presence of several professors in the classroom. Also, with the presence of several professors, many questions and discussions were raised that extended beyond the class time. However, these discussions and challenges, especially with the presence of professors of basic medical sciences and clinicians, were a strength of the class both for the students and for the professors.

### Conclusion

In general, the integration of the basic and clinical subjects helps students to better understand the pathophysiology of diseases, improves their abilities, grows their personal talents, and prepares them to have an excellent level of mastery and expertise for their future profession.

### Suggestions for future studies

It is suggested that this teaching method be used not only in the Infectious Disease course but also in other clinical courses. Moreover, this method should be offered at least in a few sessions for each course. In this way, students can gain a more accurate understanding of the relationship between basic and clinical sciences and will be able to apply their knowledge of basic medical sciences in disease diagnosis and treatment.

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**Conflict of interests:** None declared.

### Ethical approval

The present study was designed and conducted as an educational scholarship project approved by the center for the development of medical education (EDC) at Birjand University of Medical Sciences, and the need for its ethics approval was waived by the Vice Chancellor for Education

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