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# Horizontal integration in basic sciences at Kerman University of Medical Sciences: medical students' viewpoint

Habibeh Ahmadipour<sup>1\*</sup>, Farideh Hajmohammadi<sup>2</sup>

<sup>1</sup>Department of Community Medicine, School of Medicine, Kerman University of Medical Sciences, Kerman, Iran

<sup>2</sup>School of Medicine, Kerman University of Medical Sciences, Kerman, Iran

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## Abstract

**Background:** Integrated curriculum is a strategy in educational planning. Recently, this strategy has been introduced to medical universities in Iran. The strategy is running at a different level in some of the universities including Kerman University of Medical Sciences (KUMS). In this study, students' viewpoints toward the horizontal integration of basic sciences were assessed.

**Methods:** This cross-sectional study was carried out on 144 fourth- and fifth-year medical students at KUMS. They were selected using the census method. Data was collected using a questionnaire that contained demographic data, 26 questions about different aspects of the horizontal integration program in basic sciences and 2 questions about students' satisfaction with the program. The range of viewpoint and satisfaction scores were 0 to 104 and 0 to 10, respectively. Data was analyzed by SPSS 19.

**Results:** The majority of participants 83 (57.6%) were female. The means of their viewpoint and satisfaction scores were  $58.44 \pm 10.61$  and  $5.48 \pm 2.11$ , respectively. These scores had no statistically significant difference according to age, gender, entrance year and grade point average (GPA) ( $P > 0.05$ ). Only students' satisfaction score had a significant direct correlation with GPA ( $r = 0.3$ ,  $P = 0.006$ ).

**Conclusion:** Although our study revealed a positive viewpoint toward the new educational method, this reaction is the first step of evaluation and the next stages of evaluation must be conducted to determine existing problems.

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## Introduction

In our country, medical students start their educational curriculum with basic sciences, which often lasts 2.5 years. After passing a basic sciences comprehensive exam, the clinical stage starts in which medical students deal with the diagnosis, care and cure of disease.<sup>1</sup> Until a few years ago, basic science courses were typically taught as independent, discipline-based courses. In this traditional method, students do not get a comprehensive view of the structure and function of the human body and the relationship between them.<sup>2</sup> The integrated curriculum model was introduced by Beane in 1977 for general education and used in medical education by Harden et al in 1984.<sup>3</sup> Harden et al defined integration as "the organization of teaching matter to interrelate or unify subjects frequently taught in separate academic courses or departments. This organization can take place across a seemingly infinite spectrum of time periods or depths both within and

among subjects."<sup>3</sup> There are two main forms of integrated curriculum in medical education: horizontal and vertical integration. In horizontal integration, courses that are within a subject are integrated with each other. For example, basic sciences courses such as anatomy, physiology and biochemistry are integrated. In vertical integration, courses from basic to advanced levels of training in the medical curriculum can be integrated.<sup>4</sup>

Many researchers have studied the effect of integration in medical education. Some of them found integrated curricula promote retention of knowledge.<sup>3,4</sup> Bradley and Mattick revealed integrated programs promote deep learning, improve satisfaction and motivation and help medical students to have a better view toward clinical applications of basic sciences and comprehensive understanding of basic concepts.<sup>5</sup> In a mixed methods study, Eisenbarth et al found that "promotion of basic understanding of science concepts, integration of foundational and applied learning

\*Corresponding Author: Habibeh Ahmadipour, Email: ahmadipour@kmu.ac.ir



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and maximization of students' engagement and motivation are the values of integrated courses.<sup>6</sup> In our country, about 15 medical schools considered integration for revising their traditional curriculum. Most of them used horizontal integration of basic sciences. In Kerman University of Medical Sciences (KUMS), our general medical curriculum changed in September 2011. Our traditional discipline-based courses in anatomy, physiology, histology and embryology were re-designed as introductory of basic sciences and eight organ-based systems through horizontal integration. Also, we considered early clinical contact for second-semester medical students as the first step of vertical integration.<sup>7</sup>

One of the most important elements in designing and implementing any educational program is comprehensive evaluation.<sup>1</sup> After conducting two periods of horizontal integration of basic sciences in our general medical curriculum, it was necessary to evaluate this program. As the first step of evaluation, we used the first level of Kirkpatrick's four-level education model. Kirkpatrick's model is a well-known method for educational program evaluation. These four steps include learners' *reaction* to an educational intervention, the *learning* actually acquired from the educational experience, the changes that take place in the *behavior* of learners and the *result* of the educational program on learners' practices.<sup>8</sup> Therefore, this study aimed to investigate students' viewpoint toward horizontal integration of basic science courses in KUMS.

### Material and Methods

This research was a cross-sectional study carried out by the Educational Development Office (EDO) in Medical School of KUMS. Our statistical population included all medical students entering KUMS in September 2011 and 2012 who were selected through the census method.

The data was collected using a self-administered questionnaire consisting of three sections. The first section included questions on demographic data, such as age, gender, entrance year and students' grade point average. The second part consisted of 26 questions that assessed medical students' viewpoints toward different aspects of horizontal integration (program planning, execution, coordination, the exams' organization and authorities' accountability), framed on the basis of a structured literature review. The questions were answered based on a 5-point Likert scale, 0 for completely disagree and 4 for completely agree. Therefore, the minimum and maximum scores were 0 to 104, respectively. The last section included 2 questions about participants' satisfaction toward the program and its different aspects based on a score of 0 to 10, with 0 indicating no satisfaction and 10 representing full satisfaction. Face validity of the questionnaire was confirmed by a number of medical education experts and revised according to the feedback. The content validity index (CVI) was 0.8. The reliability of the questionnaire was determined in a pilot study using Cronbach  $\alpha$ , which was calculated at 0.75. The questionnaires were distributed and completed either before or after weekly formal classes. Ten minutes were re-

quired to complete the questionnaire.

Data were analyzed by SPSS version 19 using independent *t* test, Mann-Whitney U test and correlation tests.

### Results

In September 2011 and 2012, 180 medical students entered KUMS, and 144 of them participated in our study (participation rate: 80%). The mean of their ages was  $20.67 \pm 7.03$ . Most of them (83 or 57.6%) were female. Table 1 shows demographic characteristics of the participating medical students.

The mean of their viewpoint score toward different aspects of horizontal integration was  $58.44 \pm 10.61$ , with the minimum and maximum of 41.0 and 85.94, respectively. It had a normal distribution in the one sample Kolmogorov-Smirnov test ( $P=0.63$ ). This score was  $59.33 \pm 10.6$  and  $57.79 \pm 10.6$  in male and female students, respectively. The difference was not statistically significant in independent *t* test ( $P=0.4$ , 95% CI = -2.00-5.08,  $d=0.14$ ). Also, there was not a statistically significant difference in this score according to the academic year of the entrance ( $P=0.9$ , 95% CI = -3.11-3.90,  $d=0.04$ ). The mean of students' satisfaction score was  $5.48 \pm 2.11$ , with the minimum and maximum of 0 and 10, respectively. It did not have a normal distribution in the one sample Kolmogorov-Smirnov test ( $P=0.001$ ). There was no statistically significant difference in this score according to gender ( $P=0.34$ , 95% CI = -0.37-1.04,  $d=0.16$ ) and the academic year of entrance ( $P=0.43$ , 95% CI = -0.42-0.97,  $d=0.13$ ). Table 2 shows the comparison of participants' satisfaction scores with a different aspect of the horizontal integration of basic sciences according to gender and entrance year. The greatest satisfaction was for the exams and the least satisfaction was for program notification and authorities' accountability.

In correlation tests, there was a statistically significant weak correlation between students' satisfaction score and their grade point average ( $r=0.3$ ,  $P=0.006$ ). Also, a statistically significant moderate correlation was found between students' satisfaction and viewpoint scores ( $r=0.42$ ,  $P=0.001$ ).

One hundred nine participants (75.7%) agreed or completely agreed that simultaneous presentation of basic sciences courses led to a more profound understanding of

**Table 1.** Demographic characteristics of the participating medical students

Variable	
Age, Mean (SD)	20.69 (1.45)
Grade point average, Mean (SD)	15.32 (1.77)
Gender, No. (%)	
Male	61 (42.4)
Female	83 (57.6)
Entrance year, No. (%)	
2011	71 (49.3)
2012	73 (50.7)

**Table 2.** The comparison of participants' satisfaction scores with different aspects of horizontal integration of basic sciences according to gender and entrance year

	Program planning Mean (SD)	Program execution Mean (SD)	Program coordination Mean (SD)	Program coordination Mean (SD)	The exams Mean (SD)	Authorities accountability Mean (SD)
<b>Gender</b>						
Male	4.45 (2.81)	5.03 (2.70)	4.34 (2.40)	4.13 (3.15)	6.24 (2.66)	4.12 (2.79)
Female	4.36 (2.94)	4.61 (2.34)	4.16 (2.20)	3.52 (2.79)	5.15 (2.82)	3.52 (2.55)
<i>P</i>	0.85	0.31	0.63	0.22	0.02 <sup>a</sup>	0.18
<b>Entrance year</b>						
2011	4.38 (2.92)	5.04 (2.40)	4.58 (2.23)	4.28 (2.94)	6.15 (2.53)	3.98 (2.76)
2012	4.22 (2.84)	4.55 (2.59)	3.91 (2.30)	3.30 (2.90)	5.09 (2.95)	3.57 (2.56)
<i>P</i>	0.45	0.24	0.08	0.04 <sup>a</sup>	0.02 <sup>a</sup>	0.36

<sup>a</sup>The value less than 0.05 is statistically significant.

the subjects. Seventy-seven (53.5%) agreed or completely agreed that in this educational system, students were more motivated to learn. Seventy-eight (54.1%) agreed or completely agreed that the integration method provided a better connection between basic and clinical science subjects. Seventy-nine (54.9%) agreed or completely agreed that this method reduced the amount of duplicate content. Also, 72 (54.9%) and 66 (54.9%) agreed or completely agreed that this method made students confused and created stress, respectively.

## Discussion

Our study revealed students' viewpoints and satisfaction with the horizontal integration of basic science courses was generally positive, and that is consistent with similar studies in our country. Dehghan et al found medical students at Yazd University of Medical Sciences had a moderate viewpoint toward horizontal integration of basic sciences courses.<sup>9</sup> Ejtemaei Mehr et al revealed that medical students' viewpoints regarding the integrated module of basal ganglia was positive in Tehran University of Medical Sciences.<sup>10</sup> Amini et al found that medical students in Shiraz were more satisfied with horizontal integration after the problems got resolved.<sup>1</sup> Teimouri Jervekani et al studied students' satisfaction with the simultaneous presentation of anatomy and physiology courses in Isfahan. They found the satisfaction score of medical students trained with these courses was significantly higher than students trained in the traditional curriculum.<sup>11</sup> Rehman et al showed overall satisfaction with the integrated learning program (ILP) in 78% of students.<sup>12</sup> Although there were significant differences in some program dimensions according to gender and entrance year, the overall viewpoint and satisfaction had no difference according to the considered variables. This indicates that perhaps other variables influence students' satisfaction.

In our study, more than half of students agreed or completely agreed that simultaneous presentation of basic sciences courses led to a more profound understanding of the subjects, more motivation to learn, better connection between basic and clinical science subjects and reduced the amount of duplicate content. These results are com-

patible with similar studies.<sup>1,5,12</sup> In the Shiraz study, medical students reported the integration program led to active participation in the class, more motivation and self-confidence.<sup>1</sup> Ward revealed that "horizontal integration of the basic sciences in the chiropractic curriculum promote more clinically relevant learning, improved learning outcomes".<sup>2</sup>

In our study, more than half of participants reported the new curriculum made them confused and created stress that has been mentioned in the study of Amini et al as well.<sup>1</sup> This may be due to problems in the design and coordination of the program. According to our participants' viewpoints, they had the least satisfaction with program notification and authorities' accountability in our system which made our students gone under stress and confused. Therefore, it is essential that our educational system specifically targets these issues in the revision of new educational methods. Brauer and Ferguson considered three points for improving integration: being sure of simultaneous presentation of integrated content, avoiding the appearance of less importance for basic sciences and using unified definitions.<sup>3</sup>

Another challenge of integrated curriculum is the fear of threatening the existence of the individual disciplines, which was pointed out by Achike. He recommends that all those who are involved in designing new educational programs must be well-trained.<sup>13</sup> In our country, the revision of general medical education has been delegated to every university. So, we have a different type of new curriculum causing trouble for students. These newly-designed programs, under the title of integration, require serious review, revision and coordination. Therefore, if other new similar curriculum was assessed, we may detect similar findings. It is initially required that each university seriously assess problems related to the new program and determine strengths and weaknesses. Then, at the national level, all programs are evaluated and synchronized as much as possible.

Our study was a cross-sectional study. Another limitation was that data collection was based on the participants' viewpoint, which may not provide a precise picture of the situation. We did not have any control group to compare

our results with. We did not consider any confounder. It is recommended for future studies to evaluate the faculties' point of view about this educational method, especially through qualitative studies. It is useful for our policymakers to recognize the bugs and provide practical solutions to remove them to the extent possible.

### Conclusion

Our study revealed that medical students, after passing the basic sciences stage, had a virtually positive view toward the new educational method. However, besides relative satisfaction, they felt confused and concerned. Given that the learner reaction is the first level of Kirkpatrick's four-level education model, it is our duty to review the program in consecutive reviews and try to remove the bugs.

### Ethical approval

The questionnaires were completed anonymously and voluntarily. The participants were assured that the data would be used only for research purposes. The study, including the questionnaire, was approved by the research review board at KUMS.

### Competing interests

Authors declare that they have no competing interests.

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