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The Effect of Blended Learning on Teaching Applied Biostatistics for Postgraduate Medical Students

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Abstract

Introduction: Unlike the face-to-face courses offered on campus, online courses are predominantly asynchronous, where students basically decide when they can attend online courses. There is also an intermediate method referred to as blended learning (BL) that combines the merits of both methods. This study investigates the effect of blended learning on attitude and learning applied Biostatistics.

Methods: The students' comprehension levels and attitudes were measured for both groups. The face-to-face group is so designed as to include 16 weeks of two-hour sessions, one session weekly, in one semester. The blended-learning group is designed to receive in one semester 16 weeks of two-hour sessions, one session weekly, such that initially, the group receives four sessions of electronic educational content and then eight sessions of blended learning. The scores attitudes of students from either group were obtained after the final exam and via the university's course evaluation system. The final exam score of both groups based on the results of the student's Bachelor's degree was compared using ANCOVA in terms of either teaching methods.

Results: The numbers (proportions) of the participants attending Environmental Health, Waste Management, and Elderly Health courses were 14 (35%), 13 (32.5%), and 13 (32.5%), respectively. The mean (SD) of the scores for the blended-learning group with 18 participants was 16.69 (2.45), which was significantly higher than the score of 14.49 (2.67) for the face-to-face learning group with 22 participants (P = 0.013). Comparisons were made after adjusting the average on the bachelor's degree of both groups.

Conclusion: In addition to the improved score for the BL group, the attitudes differed. Therefore, this method is recommended for teaching Applied Biostatistics.

Keywords: Blended-learning, Postgraduate students, Student’s attitude

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Introduction

The ways that students try to learn are rapidly growing these days. Face-to-face education involves traditional classroom learning that helps students feel better by attending classes and speaking to their classmates and teachers. However, it has such demerits as taking up too much time and money for going on trips and buying textbooks (1), added to the health risks involved (2).

A fully-online approach to educational programs is recognized as an economical alternative to face-to-face teaching (3). Within only a few years, the application of digital media for teaching and learning referred to as e-learning, has increasingly become widespread in a short time (4). This method provides many opportunities for people seeking to acquire skills, re-train, and undertake further studies (4). Despite all the benefits of this method, the lack of effective instructor-student communication in online learning environments could be a problem, especially in issues where students lack a comprehensive background (5). An incomplete transfer of knowledge could occur because of the absence of direct feedback methods available to the on-campus instructors (6). Although cultivating knowledge about how teachers deliver information could accommodate the problem (7), adopting a middle ground between the two methods of teaching, that is, face-to-face and online can be helpful.

Another top trend is the emergence of "blended" or "hybrid" approaches that combine online activities and face-to-face instruction (8). This approach could combine the merits afforded by face-to-face and online learning modes of instruction (9). Several studies and meta-analyses show the merits of blended learning versus fully online learning (3,5). Generally, research has shown that blended learning (BL) leads to the students' development, success, and satisfaction (5,10).

Biostatistics has always been an essential part of the knowledge of postgraduate students of medical sciences who need to be able to analyze the data from their experiments. Nevertheless, for many students, biostatistics is perhaps the most anxiety-provoking, challenging, or critical subject in their courses of study (11). Generally, biostatistics learners face the same level of inquietude as foreign language learners. This anxiety is due to the unfamiliar content and elements that must be learned to master the content (12). Therefore, biostatistics is a subject area that requires improvement of the teaching approaches.

Using technology is utilized in various fields, especially courses on statistics. Song and Slate demonstrated how the student's

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motivation could be influenced by the teacher's well-developed online curriculum, using technology and interpersonal skills with students in a statistics class with the teaching method and quality learning materials (12) controlled. Blended learning is also employed in courses on applied statistics for postgraduate students (13). Other studies have included the teaching of statistics (14,15) in their curricula. In e-learning, the culture of the target learner plays a vital role (16), so it seems necessary to investigate the effectiveness of entirely or partly online learning in every country separately.

The universities in Iran are increasingly offering more flexible learning environments due to the postgraduate student lifestyles, which usually involve part-time work. Further, fully-online statistical courses could be impractical because of the lack of basic knowledge of statistics and related issues. Policy-makers need research-based information on the conditions under which new learning methods work and on learners' attitudes to the new methods. Therefore, this study investigated the effectiveness of blended learning in a biostatistics course for Iranian medical postgraduate students. Apart from the knowledge of statistics, their attitudes were also explored.

This study investigated and compared the postgraduate student's perceived impact of blended learning and face-to-face teaching on teaching biostatistics. It measured the understanding and attitudes of the students in such a way that the first group was so designed as to include in a 16-week semester one two-hour session weekly for face-to-face lectures. In the other group, four two-hour sessions of electronic educational content were followed by 12 two-hour blended learning sessions. During each two-hour weekly session for the blended learning, the students must deliver their homework by email. They were told and yet reminded that they were allowed to have only two sessions absent. However, the students were reminded to attend every session for blended learning.

Further, they were encouraged to read any messages or notices posted and do all the assignments for both the blended and face-to-face courses regularly. For the online course, the students were required to do an assignment and several online tests administered during the course and were encouraged to send their print or vocal questions by email. The study aimed to find out which method, blended or face-to-face, had the potential to improve the student's understanding, learning, and confidence in learning biostatistics. The effect of blended learning on students' learning and attitude was assessed.

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Participants

The participants comprised 40 enrolled for biostatistics, and the data were analyzed by SPSS offered by the School of Health at Shahid Sadoughi University of Medical Sciences. Of this number, 22 attended and successfully passed the face-to-face course in one semester. The other group comprising 18 participants attended and successfully passed the BL course. Of this number, 14 studied environmental health, 13, Waste Management, and another 13, Elderly Health. The New School of Health policy required that all graduate students pass a two-unit applied for statistical analysis course.

Scores and Questionnaire for Attitude

As required by University regulations, the course score is calculated based on a total score of 20, and scores under 14 are fails. After the final exam and before the scores were made accessible to the students, the students were asked to volunteer to complete a set of questionnaires online on the E-learning website. An attitude questionnaire to be completed by them included two sections: the first section had 14 items evaluating the teacher by the students, and the second section included student self-evaluation items. The total score for attitude was calculated through the scores made on the questions (1-5), with 5 meaning "very good." The questionnaire is available on request.

Procedure

This two-unit course included: familiarity with the principles of inferential statistics, how to input data to the software, familiarity and comparison tests of two or more independent and related groups, drawing diagrams by SPSS software, and the Chi-square test. In the combined course, by maintaining the order of 16 sessions of the topics for the face-to-face course, the topics of the chart diagram, how to input the related data to the software, and the test and chi-square test were considered as the third, seventh, eleventh and sixteenth sessions, respectively.

Results

Demographic Characteristics of Students

The numbers (proportions) of the participants attending Environmental Health, Waste Management, and Elderly Health were 14 (35%), 13 (32.5%), and 13 (32.5%), respectively. 32 (80%) were females, and 8 (20%) were males. Their details are listed in Table 1, broken down into the two groups of face-to-face and blended learning.

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Table1. Demographic characteristics of the students based on their fields and intervention group

Group			gender		Total
			Number of Females (%)	Number of Males (%)	
Face-to- Face	field	Environmental Health	5 (71.4)	2 (28.6)	7(100)
		Waste Management	6(60.0)	4(40.0)	10(100)
		Elderly Health	4(80.0)	1(20.0)	5(100)
	Total		15(68.2)	7(31.8)	22(100)
BL	Field	Environmental Health	6(85.7)	1(14.3)	7(100)
		Waste Management	3(100.0)	0(.0)	3(100)
		Elderly Health	8(100.0)	0(100.0)	8(100)
	Total		17(94.4)	1(5.6)	18(100)

Response

The students' end-of-semester exam scores were compared for the two groups once their papers were corrected. The mean (standard deviation) of the scores for the blended learning group was 16.69 (2.45), which was significantly higher than that for the face-to-face learning group, i.e., 14.49 (2.67) (p-value = 0.011). To control the effect of the intelligence of the students, the GPA for the students' Bachelor's degree study program was used as a confounder variable in an ANCOVA (analysis of covariance) and the end-of-semester exam scores in the group were compared. Further, for this study, the mean scores in the blended learning intervention group were significantly higher than those in the face-to-face group (p = 0.013). Table 2 shows in detail the results of the study.

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Table 2. Comparison of the means of scores for two groups

Group	Num.	Mean	Std. Deviation	Minimum	Maximum	Median	p-value	*Adjusted p-value
Face-to-Face	22	14.49	2.67	12.00	19.50	13.75	0.011	0.013
BL	18	16.69	2.45	13.00	19.75	17.25		
*** Adjusted for the Bachelor's degree study program for each student**								

At the end of the course, the learners used a questionnaire to evaluate the teacher's 14 items. They also rated themselves on three questions. The teacher was not allowed to access the details of the students' answers, but the average scores of each item for each subject were reported. The items and their means are listed in Table 3 according to the two intervention groups. As shown in Table 3, the mean scores for all the items for the student evaluation of the teacher in the blended learning group were higher than that for the face-to-face learning group. However, only for the two items "teacher's interest in using teaching aids," "interest," and the "teacher's desire to solve the scientific problems of the learners" was "significantly greater."

Table 3. Comparison of the attitudes of the two groups

Items		**Group's mean(SD)**		**mean difference (Std. Error Diff.)**	**p-value**
Teacher evaluation by the students		**Face-to-face**	**Blended**		
1	Ability to understand and convey concepts	4.57(0.16)	4.96(0.07)	0.39(0.09)	0.017*
2	Mastery of the subject	4.75(0.14)	5(0.00)	0.25(0.08)	0.088
3	Teaching method	4.62(0.36)	4.87(0.21)	0.25(0.24)	0.352
4	Teacher's interest in using teaching aids	4.70(0.10)	4.95(0.08)	0.25(0.07)	0.028*
5	Teacher's interest in teaching	4.79(0.08)	4.95(0.08)	0.17(0.07)	0.065
6	Interest in solving students' problems	4.77(0.05)	4.95(0.08)	0.18(0.05)	0.030*
7	Acceptance of students' opinions concerning the course	4.72(0.13)	4.95(0.08)	0.23(0.08)	0.059
8	Order in which the class is held.	4.76(0.11)	5(0.00)	0.23(0.06)	0.071
9	Observance of lesson topics	4.82(0.03)	4.95(0.08)	0.13(0.05)	0.058
10	Learning content to the point of learning	4.72(0.19)	5(0.00)	0.28(0.11)	0.128
11	Provide practical application of the lesson	4.72(0.19)	4.95(0.08)	0.23(0.12)	0.125
12	Impact of homework	4.62(0.23)	4.95(0.08)	0.33(0.14)	0.077
13	Introduction to reference in relation to the	4.62(0.23)	4.95(0.08)	0.33(0.14)	0.077

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	lesson				
14	Teaching unit by the instructor	4.62(0.23)	4.95(0.08)	0.33(0.14)	0.077
Students Self-Evaluation					
1	Activity in this course compared with other courses	4.60(0.10)	4.83(0.19)	0.23(0.12)	0.141
2	Interest in the course	4.58(0.34)	4.68(0.36)	0.09(0.29)	0.762
3	Interest in taking another course with this teacher	4.60(0.27)	4.95(0.08)	0.35(0.16)	0.095
*Significant at 0.05 level **The above comparisons are for the means of means for three fields due to the teacher's short access to detailed data					

Among the items in the blended learning course, three items had a perfect score: "mastery of the course," "observance of order in educational activities," and "rate of presenting the content to the point of learning." Due to the similarity of the instructor's presentation to the teaching content, the high scores for these items could be due to the feeling of receiving more attention from the learner than being influenced by the teaching method.

Even in the case of student self-assessment, the average score for the blended learning group was higher than that for the face-to-face learning group. For example, "the level of activity in this course compared to those of other courses" and "interest in taking another course with the teacher" could be due to a more pleasant feeling during the course, although it was not statistically significant.

Discussion

It has been a long time since teaching statistics has been going on at various curricular levels. The importance of knowing statistics is increasing these days. This is due to a growing trend to incorporate and expand statistics at all levels of education and a great interest in using effective teaching methods, especially for statistical concepts that are very important. Researchers have used computer simulation methods to teach these concepts. However, a literature review shows that little research has been conducted to support the recommendations. This study aimed to evaluate and summarize the effect of using blended learning in statistics courses using SPSS for Master's degree study programs and their potential impact on the learner's progress. The study also sought to provide research-based documentation for educators to change the way statistics is taught at a postgraduate level.

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For this study, the researchers compared the effectiveness of blended learning in understanding the students' learning goals, combining technology and human support to improve the learning of biostatistics for the Master of Science students studying basic medical sciences. A blended learning environment aims to provide a wide range of learning resources and experiences, along with the appropriate technological and human support based on the learner's learning needs (17). To this end, the design of a blended learning environment requires an in-depth understanding of the learner's characteristics and learning objectives. An essential aspect of the characteristics of postgraduate students of basic medical sciences for learning statistics is their diversity in their background information of statistics. In the present study, the instructor seeks to teach every basic concept.

An important issue in education is transitioning from one teaching method to another (18). Both teachers and learners use a specific format for teaching and learning. A sudden change in the teaching style may create resistance in teachers and students. The resistance can undermine the effectiveness of the new teaching methods (19). Therefore, a combined method, a middle ground between the old and new methods, can be a good step toward changing the educational system. This was also observed by the researchers engaged in the present study. Although there was a little resistance by the students at the beginning of the course, this became a significant demand at the end of the course.

When there is a multifaceted educational problem, addressing some problems and excluding other problems cannot achieve the desired result (20). The combined approach was designed and implemented by identifying each critical aspect of the issue and developing methods and resources to deal with the problems. It seems that making the right changes in the face-to-face method can solve some of the problems with the course. An important issue, for example, is improving the educational support given to students. Implementing a combined teaching method has made it possible to improve the issue desirably. In the item "Interest and interest in solving the students' scientific problems," the learners' evaluation of the teacher has made a significant leap with the combined method over the traditional method. However, because the teacher is the same for both methods, there is no difference in the degree of attention drawn to the learning problems of the learners, and this difference can be due to the more incredible feeling of support in the learners.

As for the principles of teaching using the hybrid method, there is a potential limitation

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that the hybrid method must maintain a significantly conservative element that can limit the progress over time (20). However, if the combined method is a continuous process developing over several years, it can overcome the limitation. From this point of view, the role of evaluation is critical in this developmental process. For logistical and tactical reasons, only a certain number of changes may occur in the project. However, the evaluation provides evidence for the success or failure of the new elements introduced in the combination. Successfully supportable changes can be created and expanded in the subsequent development and delivery stages. For the present study, the introduction to the course was completed using face-to-face meetings. In the initial sessions, the students were introduced to the basics of statistics and how to use SPSS. One of the essential topics in data analysis was how to input the data, which varied according to the study's design (independent or correlated data). The experience of the face-to-face course showed that when the data/ design changed from independent to correlated, the learners behaved similarly in terms of learning to that at the beginning of the course.

For this reason, the issue of including the correlated data was considered one of the topics for the absentee meetings. In the final evaluation of the combined course, almost no student had problems inputting the correlated data. In contrast, the principal problem for the students in the face-to-face course was confusion over inputting the related data on the end-of-course exam. This can later help expand the overall topic of inputting the online data.

In order to make it attractive at the beginning of the blended learning course, a combination of the students' favorite topics was used for the course. Drawing a chart with the software formed the opening of the course. Having a look at the graphic software output is generally visually appealing to the learners. This start-up made it possible to connect with offline meetings.

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بررسی تاثیر آموزش ترکیبی آمار زیستی بر یادگیری دانشجویان تحصیلات تکمیلی

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چکیده

مقدمه: برخلاف دوره های حضوری ارائه شده در سطح دانشگاه، دوره های آنلاین عمدتاً ناهمزمان هستند که در آن دانشجویان تصمیم می گیرند که چه زمانی در دوره‌ها شرکت کنند. یک روش میانی به نام یادگیری ترکیبی (BL) وجود دارد که مزایای هر دو روش را ترکیب می کند. این مطالعه به بررسی تأثیر یادگیری ترکیبی بر نگرش و یادگیری آمارزیستی می‌پردازد.

روش کار: دو ورودی مختلف از دانشجویان کارشناسی ارشد در چند رشته علوم پایه در نظر گرفته شدند. درس تجزیه و تحلیل داده‌های آماری توسط نرم‌افزار به هر کدام از این گروه‌ها به روش یادگیری حضوری یا ترکیبی آموزش داده شد. نمره و نگرش دانش‌آموزان برای هر دو گروه مطالعه به ترتیب توسط امتحان تشریحی پایانی دوره و سیستم ارزیابی درس در دانشگاه اندازه‌گیری شد. نمره امتحان پایان دوره برای مقایسه دو روش آموزش براساس معدل لیسانس دانشجویان با استفاده از ANCOVA تعدیل شد.

یافته ها: تعداد(درصد) شرکت‌کنندگان در رشته های بهداشت محیط، مدیریت پسماند و سلامت سالمندان به ترتیب ۱۴ (۳۵٪)، ۱۳ (۳۲/۵٪) و ۱۳ (۳۲/۵٪) بود. میانگین(انحراف معیار) نمرات برای گروه یادگیری ترکیبی با ۱۸ شرکت‌کننده ۱۶/۶۹(۲/۴۵) بود که به طور قابل‌توجهی بالاتر از امتیاز ۱۴/۴۹ (۲/۶۷) برای گروه یادگیری حضوری با ۲۲ شرکت‌کننده بود (p-value = 0.013). مقایسه بعد از تعدیل براساس معدل دوره کارشناسی انجام شد.

نتیجه گیری: علاوه بر بهبود نمره برای گروه آموزش ترکیبی، نگرش‌ها نیز متفاوت بود. این تفاوت در نگرش میتواند به دلیل احساس حمایت بیشتر توسط دانشجویان باشد. بنابراین این روش برای آموزش آمارزیستی توصیه می‌شود.

واژگان کلیدی: آموزش ترکیبی، دانشجویان تحصیلات تکمیلی، نگرش دانشجویان

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