



## Designing an Annual Educational Calendar of Medical Parasitology Based on Training Weeks

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### Abstract

**Background:** Parasitology is a course filled with many complicated terminologies. In this study, a guide was designed to facilitate the learning of parasitology. More precisely, an annual educational calendar of medical parasitology was designed based on the weeks of education and its effectiveness was assessed in university students of medical sciences.

**Materials and Methods:** This cross-sectional study included 174 students who were randomly divided into two intervention and control groups. At the baseline, the students were tested with a questionnaire at the beginning of each teaching session and the end of the intervention. In addition, another questionnaire was used to compare the attitude and satisfaction of students in two groups. Finally, the scores of the students were entered in SPSS 16 for analysis.

**Results:** The results of parametric tests showed that the mean scores of laboratory and medical students during several tests in different sessions were significantly different in the two groups.

**Conclusion:** The educational calendar is a new method in medical education, especially in the field of medical parasitology. This calendar as an educational supplement, emphasizes on students' active learning and contributes to improving the quality of teaching the parasitology course in addition to meeting their educational needs.

**Keywords:** Educational calendar, Parasitology, Study guide

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### Introduction

Education is important in all occupations and professions. In medical sciences, it is very important due to the nature of the existing disciplines. The training process is influenced by several factors and variables. These factors can make learners more up-to-date, including student, teacher, education, teaching and training methods, educational resources, the growing trend of educational technology and educational learning in the age of information and communication (1, 2). Teaching is among the factors that play an important role in the efficiency and effectiveness of the educational system (3).

Different educational methods have various outcomes and functions. Education specialists in higher training have focused on evaluating the impact of different educational methods for over half of a century. In the last half of the century, active learning-teaching methods

were developed in pre-university education levels (4, 5). The active methods of learning-teaching, along with an increase in students' participation in education enhance the satisfaction originated from teaching and learning. According to previous evidence, most students prefer active teaching methods (5) and in their view, good teachers are those who reinforce students' motivation by engaging them in the learning process (6). The study guide is a tool that can help students engage in active learning, serves as the support for better and faster learning, and helps the students better understand scientific concepts and topics. In addition, this guide not only increases the responsibility of students but also benefits them to manage their own learning (7, 8). The main mission of laboratory and medical sciences is to educate graduates until acquiring the necessary knowledge and skills. More importantly, this mission

should be conducted properly in various fields such as health, training, researching, and services related to laboratories and hospitals. Infectious and tropical diseases are among the most common infectious diseases around the world due to various pathogens (9, 10). Therefore, it is necessary to obtain appropriate knowledge about these pathogens for optimal performance against these diseases. Some studies addressed this important issue worldwide. After discussing the importance and status of parasitology teaching in the academic community of the United States, researchers emphasized the examples of combined and clinical applications based on solving the problems, allocating more hours to educate animal species, and encouraging students to implement simple research projects in parasitology (9). Parasitology is one of the most important lessons in the laboratory and medical sciences as it improves their professional quality and providing their services in the community. Thus, it is considered to be the educational objectives of the paramedical faculty. The students of laboratory and medical sciences have 6 and 4 parasitology courses in their study period, respectively. In this regard, the best and most effective presentation of the lessons of parasitology, as well as the accurate and regular implementation of the educational calendar of these lessons can lead to the promotion of colleagues' work in laboratory sciences and physicians at the community level. Ultimately, it may yield to more satisfaction of the clients and modify their viewpoints toward services provided in laboratories and hospitals.

However, parasitology is one of the most challenging courses, which consists of various complicated terminologies. Further, it has more contents and topics which make learning difficult for the learners. In some studies, it is shown that parasitology has always been one of the most challenging courses which causes medical students to earn lower grades compared to other courses in basic science tests (11). This is based on scholars' experiences as the faculty members and instructors of parasitology. Therefore, researchers designed a guide to better facilitate the learning of parasitology. To the best of our knowledge, no study has addressed the desktop training calendar in Iran. Accordingly, in this study, the annual educational calendar of medical parasitology was designed based on the weeks of education while its effectiveness was evaluated in university students of medical sciences.

## Materials and Methods

Prior to the research, the required approval was obtained from the Ethics Committee of Gonabad University of Medical Sciences (IR.GMU.REC.1397.026). This study consists of three steps as follows.

### a. Designing the Intervention

First, an intervention and a study guide were designed

in this study. For this purpose, suitable information about the parasitology topics, including two parts of the protozoans and helminths, was gathered from reference books (12, 13). Information about each parasite, including epidemiology, pathogenesis, diagnosis, treatment, and prevention was entered into a text processor like Word. Based on the weeks of education, which begins from the third week of September to the second week of July and lasts forty weeks, the information of each parasite was designed as an annual medical calendar for medical parasitology in the next step. It was designed so that a parasite was studied in each week. To further captivate this educational product and stimulate students' curiosity and interest, the information in this calendar, along with the form and life cycle of the parasites was utilized based on the course outlines and comparative tables. It should be mentioned that the calendar of laboratory sciences and medical students was designed considering their parasitology course educational needs.

### b. Implementation of the Intervention

This new educational intervention was carried out in two semesters including the second semester of the academic year 2016-2017 and the first semester of the academic year 2017-2018. The students' numbers were 93 and 81 in medicine and laboratory sciences, respectively. After familiarizing the students with this intervention, as well as expressing the goals of designing the calendar and obtaining student satisfaction using the lottery program, the intervention and control groups were randomly identified via GraphPad software. The procedure was approved by the ethics committee. It should be noted that all students agreed to participate in this study and signed the informed consent form. Teachers' lessons on parasitology were taught and students studied the relevant materials weekly.

### c. Evaluation of the Intervention

At this stage, two groups of students (intervention and control groups) were tested with 4 questions after a week. The tests were repeated throughout the term and one week after each teaching session, the test was taken from the two groups at the beginning of the next session. Then, the students' scores were entered into SPSS software, version 16 for analysis. It should be noted that the statistical analyst was unaware of the intervention and control groups. Independent *t* test and repeated measures ANOVA tests were used to compare the mean scores of the students. Furthermore, a questionnaire was used to compare the attitudes of the students in two groups regarding the parasitology lesson at the end of the semester. This questionnaire was designed by the researcher and comprised of 6 items on a Likert-type scale. Then, the students' attitude levels were compared in both groups using the chi-square test, followed by assessing their level of satisfaction from the calendar using a researcher-

made questionnaire. This questionnaire also had 7 items on a 3-point Likert-type scale. The questionnaires were given to 7 faculty members of the University of Medical Sciences and modifications were proposed according to their feedback. The reliability of the tools was assessed using the Cronbach's alpha method, indicating  $\alpha = 0.84$  and  $0.79$  for the attitude and satisfaction questionnaires, respectively. In addition, the interview method was used to evaluate the satisfaction and interest of the students from the educational calendar. For this purpose, interviews with students were conducted individually and face-to-face in a completely relaxed and stress-free environment during the semesters and at the end of the intervention.

**Results**

The results showed that females and males constituted 57.3% and 42.7% of the participants, respectively. The mean age was  $21.52 \pm 1.44$  years. The results of repeated measures ANOVA demonstrated that the mean score of laboratory and medical students during several tests in different sessions were significantly different in the two calendar and non-calendar groups ( $P < 0.0001$ ). In other words, students receiving an educational calendar had a higher grade compared to those without a calendar. The mean and standard deviation of the scores in the calendar group were  $18.33 \pm 1.78$  after the first session whereas those of the first scores were  $10.55 \pm 3.71$  in the control group. This difference was evident throughout the entire academic period and at the end of the semester in various student tests (Table 1). Thus, the independent *t* test was performed to determine the difference between the groups for each test during the semester, the results of which implied that there was a significant difference in the mean scores ( $P < 0.0001$ ) between the two groups in all tests (Table 1). The calculation of the strength of the effect indicated a strong impact of the intervention (eta squared = 0.867).

Figure 1 displays the mean variations and standard deviation of students' grades in medical and laboratory sciences in the two groups during the term. As shown, the minimum mean of 7.16 is for the non-calendars group while the highest mean (19.25) belongs to the calendar

group.

Furthermore, the results of the chi-square test showed a significant difference between the attitude of the intervention and control groups ( $P = 0.048$ ). In other words, the students of the calendar group had a better attitude toward the parasitology lesson. More precisely, 59.4% of the students in the calendar group had a good attitude toward parasitology while only 21 (24.3%) students had a good attitude toward parasitology in the non-calendar group (Table 2).

The results also revealed that the calendar group had a high level of satisfaction with the educational calendar. In other words, students (86.5%) had high satisfaction and none of them had a low satisfaction (Figure 2).

To have a deep assessment of students' attitude, interest, and satisfaction, a face-to-face interview was used in addition to the questionnaire. For this purpose, 11 medical and laboratory students were interviewed and the interview was conducted in one of the classrooms of the University of Medical Sciences in a relaxed environment. The duration of the interviews varied from 20 to 45 minutes. The interview analysis showed that students with a calendar had a higher degree of satisfaction regarding the parasitology lesson and their interest in this course increased gradually. In this regard, one student stated that:

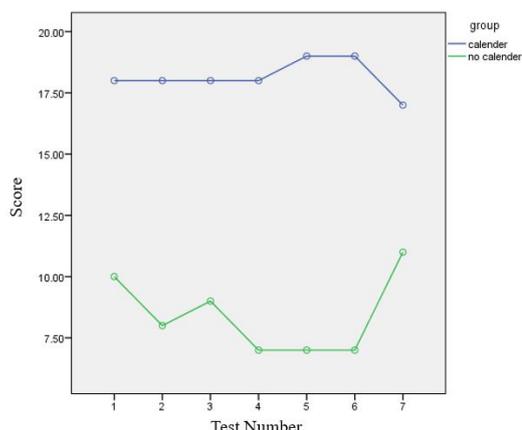


Figure 1. The Mean Scores of Students in Two Groups.

Table 1. Comparison of Mean and SD of the Students' Scores in Two Groups During Seven Tests

Group	Test Number							RM ANOVA
	1	2	3	4	5	6	7	
	Mean ± SD							
Calendar	18.33±1.78	18.57±1.52	18.37±2.26	18.33±4.71	19.25±1.03	19.00±1.06	17.91±2.48	df=1, F=117.53, P<0.0001
Without calendar	10.55±3.71	8.80±5.77	9.16±4.96	7.77±4.34	7.16±6.63	7.66±6.97	11.10±3.57	
Total	13.66±4.94	12.71±6.65	12.85±6.13	11.99±6.87	12.00±7.92	12.20±7.81	13.83±4.62	
Independent t test	T=5.647 P<0.0001	T=5.511 P<0.0001	T=5.031 P<0.0001	T=4.620 P<0.0001	T=5.320 P<0.0001	T=4.852 P<0.0001	T=4.665 P<0.0001	df=3.051, F=0.352, P=0.791,

Note. RM ANOVA: repeated measures analysis of variance; SD: standard deviation.

**Table 2.** Comparison of Students' Attitudes Toward Parasitology in Two Groups

Attitude	Without Calendar Group	Calendar Group	Chi-Square Test
Weak	35 (40.5)	19 (21.6)	$\chi^2=6.09,$ $df=2,$
Moderate	31 (35.2)	16 (19.0)	
Good	21 (24.3)	52 (59.4)	$P=0.048$
Total	87 (100)	87 (100)	

*"The parasitology lesson of this semester is one of the best lessons that were presented to us in the basic sciences. We are curious not only to read the content but also to look at their photos every time we put up the calendar. My attitude differed about parasitology, and now, I think it is really excellence and I like it."*

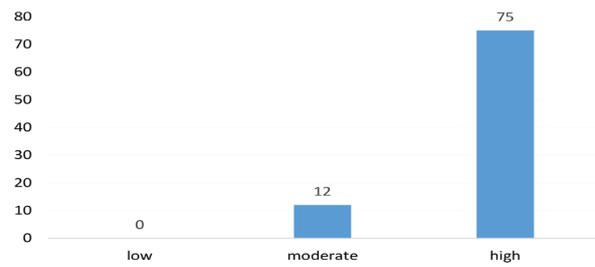
About accelerated learning, one of the students indicated that:

*"The contents of the calendar were summed up and we learnt them in the least amount of time. Understanding the parasitology lesson was desirable for us. The calendar has photos and colors which attract our attention to read its content. I was tempted to look at it over and over again and I think it had a great effect on my learning."*

## Discussion

The results of this study demonstrated that the students' learning with the educational calendar improves more when it is compared to the conventional method. In other words, the students, who received the educational calendar, had a better understanding of the parasitological concepts and learnt the corresponding materials faster. These findings are in line with those of different studies. Various studies showed that different educational packages make learning better and faster (14-17). For example, Kornell conducted a study on the impact of two types of flashcards on student learning and found that flashcards have a positive effect on learning. Moreover, flashcards with large educational packages have a greater impact on student's learning (15). In another study, Chien investigated the effect of three types of online English flashcards on student's learning (14).

Some studies also reported that there is no difference between teaching packages and conventional teaching methods (18-20). However, the package in the present study was not used alone. Hence, traditional methods were taught to both groups and an educational calendar was provided to the intervention group. Additionally, several studies focused on the effectiveness of the study guide on students' learning (21, 22). In the present study, the intervention was presented to the students at the beginning of the school year while the last lesson of the course coincided with the last week of the school year.

**Figure 2.** Absolute Frequency of Students' Satisfaction With Educational Calendar.

On the other hand, in previous research interventions, the timetable for student education was not used whereas the application of the timetable of this study for educating the students was a strong point of this study, which most students agreed on. Another advantage of this intervention was the use of tables to compare two parasites similar to each other to demonstrate the similarities and differences. Moreover, this educational calendar of the parasitology course included the shapes of parasites and their life cycle, making them easy and understandable. On the other hand, given that this calendar resembles a real calendar on the table, this product is available to the student and the student's motivation is enhanced to study this educational calendar. To the best of our knowledge, this study is the first one to address this issue in Iran.

Active teaching and education, which emphasize the participation of students in the education process, have received special attention since many years ago. This action increases the depth of the student's learning while developing a sense of responsibility and learning motivation (23). In addition, it prepares them for lifelong learning, as well as the continuity of professional studies at the time of employment. Further, the educational calendar is a new method in medical education, especially in the field of medical parasitology. This calendar, as an educational supplement, emphasizes on their active learning and contributes to improving the quality of teaching the parasitology course in addition to meeting the educational needs of the students (23).

## Conclusion

In general, the educational calendar is considered as a new method in medical education, especially in the field of medical parasitology. The findings of our study showed that the educational calendar as a study supplement can improve the students' parasitology course scores.

## Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

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the university.

#### Ethical Statement

The study was approved by the Ethics Committee of Gonabad University of Medical Sciences (IR.GMU.REC.1397.026).

#### Authors' Contributions

All the authors made contributions to the proposal and design of the study, the acquisition of the data, as well as the analysis and interpretation of the data. Furthermore, they cooperated on drafting the article and revising it critically for important intellectual content, along with approving the final version of the study for submission.

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#### Informed Consent

The present study was conducted after informed consent had been obtained from all participants.

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