

Comparison of Virtual and Actual Education Models on the Learning of Internal Interns During the Pandemic of COVID-19

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Abstract

Background: Following the outbreak of coronavirus and its impact on the educational process of medical students, attention was paid to e-learning due to importance of education and research. The aim of present study is to evaluation of virtual and actual education models on the learning of internal interns during the pandemic of COVID-19.

Results: The mean±SD age of the participants was 24.9±2.3 years, 46% of participants were men and 54% of them live in dormitory. Results of study shows that difference of pre-test and post-test score with actual and virtual education models in the male and female is significantly different (P value=0.020). Virtual education for men and actual education for women have resulted in higher difference scores in pre-test and post-test. Actual and virtual education models were no different in academic achievements of participants. Thus, the scores obtained in 9 areas did not make a significant difference between the two types of educational models.

Discussion: Virtual and actual education methods for internal interns were examined and the results showed that there is no significant difference between these two methods in student output. Given the conditions that have created by COVID-19 disease in the world, it seems that the use of virtual education can be a good alternative to educating medical students so that education does not stop.

Introduction

Evaluating and inventing desirable educational models is one of the most important tasks of educational system. Development and access to internet caused expansion in the virtual education and virtual universities in the field of education (1). Following the outbreak of coronavirus and its impact on the educational process of medical students, attention was paid to e-learning due to importance of education and research. Since social distance is the best way to prevent COVID-19, this issue with definitely involve medical students as well. In this regard, medical school in response to COVID-19 pandemic have tried to hold the training of this course virtually, and in some school, clinical skills training classes have been held online. Evaluation is also carried out online. There are also challenges due to the suddenness of this change in the training process and the attention paid to web-based (virtual) distance learning.

At this time, the challenge facing medical schools is to train externs and interns and create appropriate clinical experiences for them in dealing with patients, which does not seem to be easily achieved with virtual and online training (2). Therefore, it is necessary to evaluate the courses that are presented virtually in order to better prepare educational activities in cyberspace. On the other hand, because student evaluation methods in Iran have been more face-to-face, so there are shortcomings in virtual evaluation along with virtual education (3–5).

One of the main foundations of the virtual education process is the evaluation of educational outcomes. In fact, evaluation and measurement is an essential component of the educational system through which the performance of learners is observed and evaluated. Inclusive evaluation is an important part of the distance education program (6). Effective evaluation allows examining the effectiveness of the virtual teaching method and comparing it with the actual teaching method, which has been considered in the project (7).

In today's fast-paced world, many teaching methods are slow and inefficient and do not have the power to convey new concepts to learners, so it is necessary to use new technology in this regard. The move to new approaches to education has led many universities around the world to use e-learning technology in their courses, and this is more important these days in the shadow of the Corona pandemic (8).

Comparing the effectiveness of virtual and actual training is one of the most important design principles of virtual training. Knowing in which areas e-learning is likely to be less sufficient for learners to learn, or what factors may affect the effectiveness of e-learning, will help to establish the best e-learning practices.

Given the situation in the corona pandemic and the need to create a physical distance between people, the need to use virtual training is much more important than before. In this regard, the aim of present study is to evaluation of virtual and actual education models on the learning of internal interns during the pandemic of COVID-19.

Materials And Methods

The present study is a randomized clinical trial that was performed on 112 internal interns of Firoozgar Hospital in 2020. In each season, 28 interns were present in the internal department for 3 months, who was randomly assigned to one of the actual or virtual educational model groups with personal consent.

Ethical committee of Iran University of Medical Sciences approved all experimental protocols. Informed consent was obtained from all subjects involved in this study.

Group 1 (actual education)

14 interns learned about internal emergencies priorities approved by the internal group with actual educational model (wearing a mask and observing physical distance). In this method, at the beginning of the class, 10 questions were displayed for interns using the online software of Porsline and WhatsApp social network, and after recording the answer by them, online graphs of correct answer percentage was drawn on the class screen without mentioning the name of the examiner. Then, the training was done in the form of case presentation (history, examination, diagnostic and treatment plans, respectively) and at the end, 10 questions were displayed for the interns again using the online software of Porsline and WhatsApp social network. Answers by them, online graphs of correct answer percentages were drawn on the class screen without mentioning the name of the examiner, and by comparing these two tests, students noticed

an increase in their knowledge of the subject taught. During the class, the interns were asked 10 intervention questions that they had to send to the instructor using the online software Porsline and WhatsApp social network.

Group 2 (virtual education)

14 interns learned about internal emergencies priorities approved by the internal group with virtual educational model (using Adobe Connect software). As the same previous model, in this method also at the beginning of the class, 10 questions were displayed for interns using the online software of Porsline and WhatsApp social network, and after recording the answer by them, online graphs of correct answer percentage was drawn on the class screen without mentioning the name of the examiner. Then, the training was done in the form of case presentation (history, examination, diagnostic and treatment plans, respectively) and at the end, 10 questions were displayed for the interns again using the online software of Porsline and WhatsApp social network. Answers by them, online graphs of correct answer percentages were drawn on the class screen without mentioning the name of the examiner, and by comparing these two tests, students noticed an increase in their knowledge of the subject taught. During the class, the interns were asked 10 intervention questions that they had to send to the instructor using the online software Porsline and WhatsApp social network.

The learning outcomes of the interns of these two groups were compared in 9 areas with 95% confidence level and 5% random error.

1. Average score of multiple choice theory test at the end of each month (MCT)
2. Average score of descriptive theory test at the end of each month (Exam)
3. Average score of the recall test 10 days after the end of each month (Recall)
4. Average score of PMP theory test at the end of each month (PMP)
5. Average score of "approach to the patient" practical test based on the orders written by the interns on the patient's bedside in the emergency ward from the course content which is held monthly (Approach)
6. Average score of "Hx and Ph.E" practical test based on the history and examination performed by interns on the patient's bedside in the emergency ward which is held monthly (HxandPhE)
7. Average score of the interns' survey questionnaire in each month (Form)
8. Average score of differences between the post-test and pre-test in each session (PostPre)
9. Average score of 10 intervention tests per session (Interactive)

Data about age, sex, type of residence (home or dormitory), pre-internship score (≤ 150 or > 150) and entrance exam rank (≤ 300 or > 300) were collected.

Continuous variables are reported as mean \pm SD. In order to test the difference between mean of 9 tests score across demographic variables Two-way ANOVA was used. Difference between average score of 9 areas in actual and virtual models were assessed by Independent sample t-test. Data were analyzed using SPSS Version 20 (IBM Corp, Armonk, NY, USA). For all statistical tests, p values ≤ 0.05 were considered statistically significant.

Results

The mean \pm SD age of the participants was 24.9 ± 2.3 years, 46% of participants were men and 54% of them live in dormitory. Results of study shows that difference of pre-test and post-test score with actual and virtual education models in the male and female is significantly different (P value = 0.020). Virtual education for men and actual education for women have resulted in higher difference scores in pre-test and post-test, Table 1.

Table 1
The effect of age, sex, pre-internship score, entrance exam rank, accommodation type and type of education on scores obtained

	MCT		Exam		Recall		PMP		Approach to patient test		Hx& PHE		Average Survey Score	
	Virtual	Actual	Virtual	Actual	Virtual	Actual	Virtual	Actual	Virtual	Actual	Virtual	Actual	Virtual	Actual
Age	75.24	73.46	78.31	80.56	67.78	68.12	70.59	71.41	71.24	70.83	77.26	75.68	83.16	78.34
≤ 25 years > 25 years	70.64	71.46	78.36	79.53	66.85	63.33	68.92	66.60	64.78	66.06	74.14	75.53	72.35	80.60
p-value	0.786		0.873		0.720		0.697		0.845		0.673		0.084	
Sex	69.33	74.76	74.81	80.00	62.26	68.61	67.78	72.06	66.55	70.76	74.22	77.17	80.44	81.11
Female Male	78.48	70.09	81.58	80.72	72.48	64.09	72.41	67.13	72.48	67.68	78.58	73.27	80.48	75.59
p-value	0.098		0.305		0.120		0.181		0.243		0.184		0.411	
Accommodation type	76.28	69.52	82.25	80.26	70.46	63.04	73.57	67.34	71.96	66.91	79.10	73.47	81.03	76.30
Home Dormitory	71.85	75.30	74.39	80.30	64.64	69.48	66.78	72.06	67.28	71.39	73.85	77.15	79.89	80.78
p-value	0.222		0.177		0.196		0.106		0.233		0.150		0.404	
Pre-internship score	63.70	64.24	70.04	74.24	55.12	56.38	62.16	61.71	60.71	62.00	69.83	70.38	77.37	74.47
≤ 150 > 150	81.84	78.14	84.53	83.91	76.87	73.11	76.18	75.17	76.31	74.08	81.46	78.80	82.78	81.63
p-value	0.593		0.383		0.572		0.933		0.631		0.592		0.796	
Entrance exam rank	76.68	76.41	80.90	83.29	71.62	71.14	74.06	72.17	73.93	70.91	80.15	76.79	82.53	78.67
≤ 300 > 300	70.58	67.54	74.87	75.63	62.12	60.18	65.00	66.95	63.87	67.45	71.58	73.86	77.70	79.36
p-value	0.741		0.780		0.876		0.587		0.388		0.360		0.418	

Actual and virtual education models were no different in academic achievements of participants. Thus, the scores obtained in 9 areas did not make a significant difference between the two types of educational models, Table 2.

Table 2
Difference between average score of 9 areas in actual and virtual models

	Actual	Virtual	p-value
MCT	72.93 ± 22.03	74.07 ± 21.52	0.782
Exam	78.32 ± 15.62	80.28 ± 15.10	0.500
Recall	67.55 ± 24.50	66.84 ± 24.85	0.879
PMP	70.18 ± 18.64	70.12 ± 18.46	0.988
Approach to Patient Test	69.62 ± 20.26	69.55 ± 19.73	0.985
Hx & PHE	76.84 ± 16.40	75.64 ± 15.90	0.784
Average Survey Score	80.46 ± 18.25	78.94 ± 16.83	0.684
Post-Pre Difference	4.11 ± 5.45	4.16 ± 4.90	0.913
Interactive	73.86 ± 15.03	72.59 ± 16.02	0.667

A two-way ANOVA was conducted that examined the effect of age, sex, pre-internship score, entrance exam rank, accommodation type and type of education on scores obtained in 9 areas, Fig. 1–45. There was an only one statistically significant interaction between the effects of sex and type of education on average score of differences between the post-test and pre-test in each session, $p = 0.020$.

Discussion

The main finding of present study is accepting the null hypothesis that there is no difference between academic achievements of internal interns with actual and virtual education models. In the present study we assess the learning outcomes in the 9 areas. Surprisingly we found that different educational models had no effect on student learning. However results of two-way ANOVA showed that actual education for women and virtual education for men have resulted in higher difference scores in pre-test and post-test.

Following the Corona pandemic, the need for changes in traditional teaching methods became inevitable. Virtual learning, which is mainly web-based, also brings challenges. To what extent learners can keep up with this style of teaching requires precise evaluation and comparison of this new method of teaching with actual training.

Just as actual training has its advantages, such as face-to-face communication, so does virtual training. Among the advantages of virtual learning can be mentioned the following. First, this method of education allows medical students to observe and interact with patients with COVID-19 while eliminating the risk of infection. In the Hofmann et al study, 92.9% of medical students were agreed with the virtual methods of teaching (9). Second, virtual education provides the opportunity for other students from different parts of the world to participate and exchange information between them. One of the strength of this mode of training is active participation of all students in clinical reasoning skills and gets a guide from tutors and peers alike. Murdock et al. (10) used the virtual method for holding morning report. Participants stated that this method is an effective and suitable method for using different physician in different physical places and reduced clinical load for the medical team.

In a study conducted by the Imperial College London, interns visited patients virtually. The results of this study show that the interns eagerly attended these visits and the patients' visits were well done without the physical presence of the patient and the doctor (11).

Like actual training, students' learning in e-learning is related to the mastery of the teacher and the correct transmission of concepts. Results of one study showed that 97.2% of students were satisfied from virtual teaching and this method was known as the efficiency of the actual method (12). Consistent with present study, Kaur et al study also confirmed satisfaction of 983 medical students with virtual teaching during the COVID-19 crisis (13).

In addition to the advantages mentioned for virtual education, this educational method also has disadvantages. One of the most important weaknesses of virtual training is no access to digital technology for some students. Availability of trustworthy internet connection (14, 15), hardware and software problems for virtual learning platforms (16, 17), problems relating to internet speed and quality (18, 19), and problems with audio and video playback (20) are the other disadvantages of this mode of teaching. Besides, in some cases, the educational website may become inaccessible due to overloaded, which can make learning difficult for learners (21).

Elimination of face-to-face training and clinical examination by medical students are other weaknesses of e-learning (22, 23). Results of recently published systematic review declare that progression of the competencies of a medical student were highly impacted by loss of clinical examinations, loss of bedside training and reduced direct patient care (22). Moreover other studies have confirmed these findings (14, 18, 24).

The move to virtual education by means of web-based medical teaching has problems in its nature. Some of these problems can be referred to lose focus and concentration whilst sitting in front of a screen (15). Besides, reduced motivation, poor communication, physical discomfort for instance exhaustion, visual issues, and muscle and joint pain, were related to virtual education especially in long period (25).

Another disadvantage of the virtual learning method is the lack of validity of evaluations and tests. Results of several studies showed that due to the lack of supervision during the exam, many of the scores obtained were significantly higher than the students' academic level based on their academic records (18, 21, 24, 25). Surprisingly, Lara et al (26) published a study whose results show that the scores obtained by 49 medical students in the objective structured clinical examination (OSCE) who participated in the teleconference were not significantly different from the scores of the same test in the form of face to face.

Conclusion

Different teaching methods each have advantages and disadvantages that by recognizing these characteristics can be selected the best of those for teaching medical students depending on condition. In the present study, the virtual and actual education methods for internal interns were examined and the results showed that there is no significant difference between these two methods in student output. Given the conditions that have created by COVID-19 disease in the world, it seems that the use of virtual education can be a good alternative to educating medical students so that education does not stop.

Declarations

• ***Ethics approval and consent to participate***

The authors received ethical approval from the Iran University of Medical Sciences Ethics Board. All guidelines were followed in accordance with ethics approval and written informed consent was obtained from all participants prior to participation in the study.

• ***Consent for publication***

Not applicable.

• ***Availability of data and materials***

The datasets used during the current project are available from the corresponding author on reasonable request.

• ***Competing interests***

The authors declare that they have no competing interests.

• ***Funding***

Iran University of Medical Sciences funded present study. The funding agent had not role in the design of the study, data collection, analysis, interpretation of data, and writing of manuscript.

• *Authors' contributions*

N.R. and N.A. contributed to the design and implementation of the research. Sh. S., B. Sh., R. A., S. A., S. B., R. B. and E. P. were involved in data collection. A.M. processed the experimental data, performed the analysis, drafted the manuscript and designed the figures. K.S.A. supervised the project. All authors discussed the results and contributed to the final manuscript.

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Figures

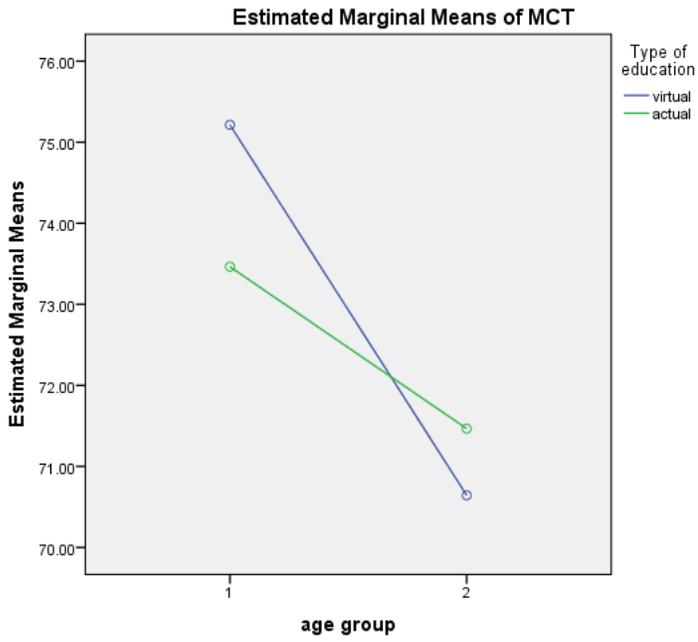


Figure 1

The effect of age and type of education on average score of multiple choice theory test at the end of each month (MCT)

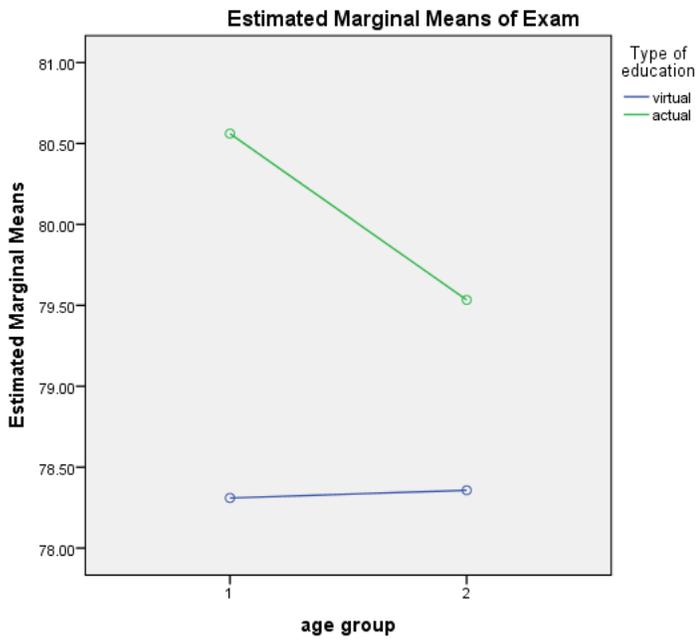


Figure 2

The effect of age and type of education on average score of descriptive theory test at the end of each month (Exam)

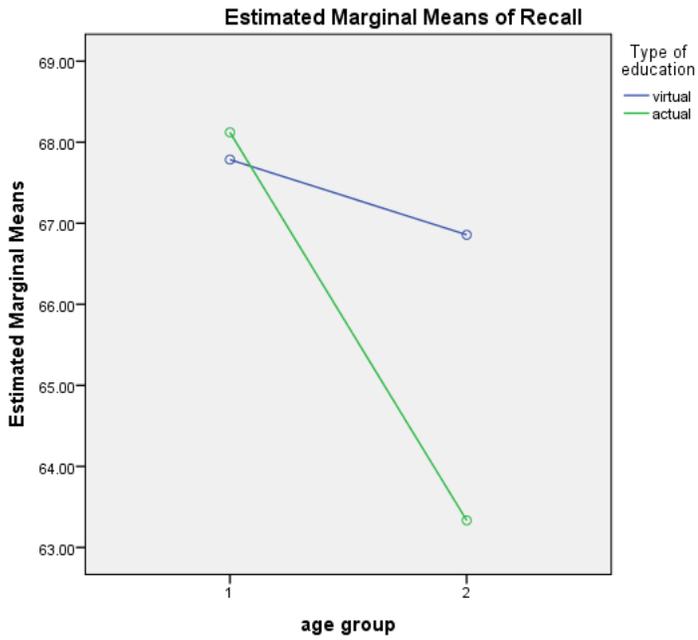


Figure 3

The effect of age and type of education on average score of the recall test 10 days after the end of each month (Recall)

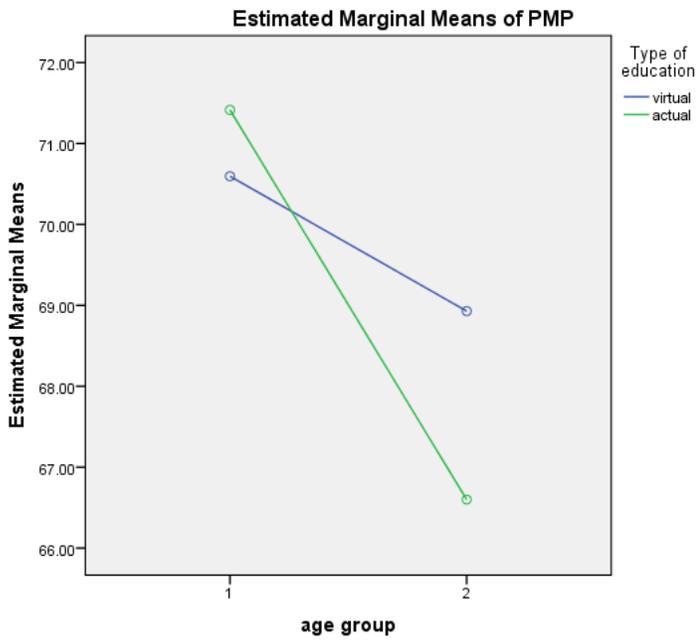


Figure 4

The effect of age and type of education on average score of PMP theory test at the end of each month (PMP)

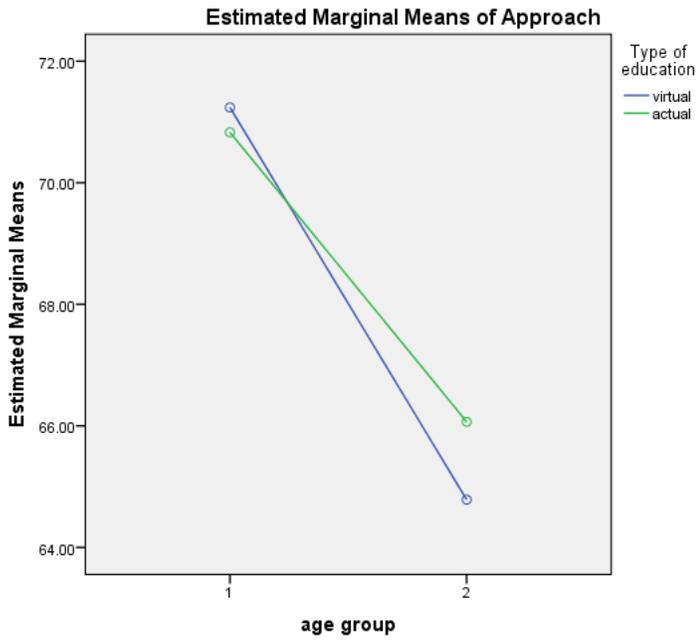


Figure 5

The effect of age and type of education on average score of "approach to the patient" practical test based on the orders written by the interns on the patient's bedside in the emergency ward from the course content which is held monthly (Approach)

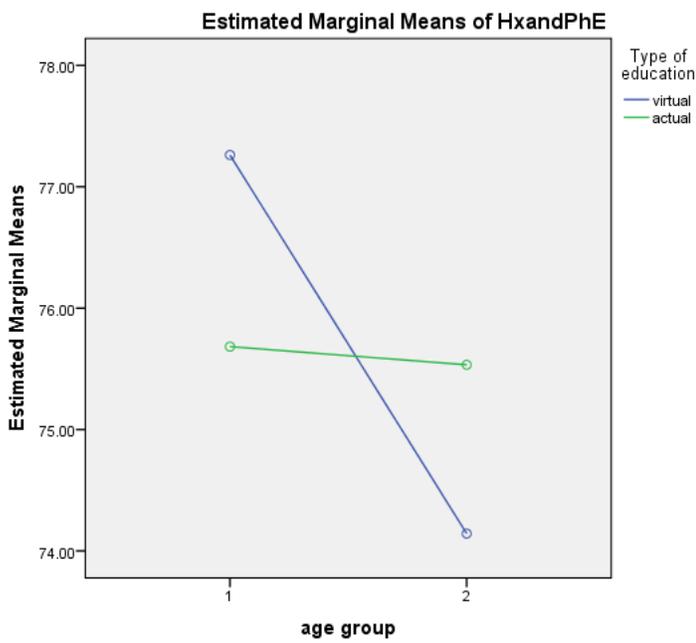


Figure 6

The effect of age and type of education on average score of "Hx and Ph.E" practical test based on the history and examination performed by interns on the patient's bedside in the emergency ward which is held monthly (HxandPhE)

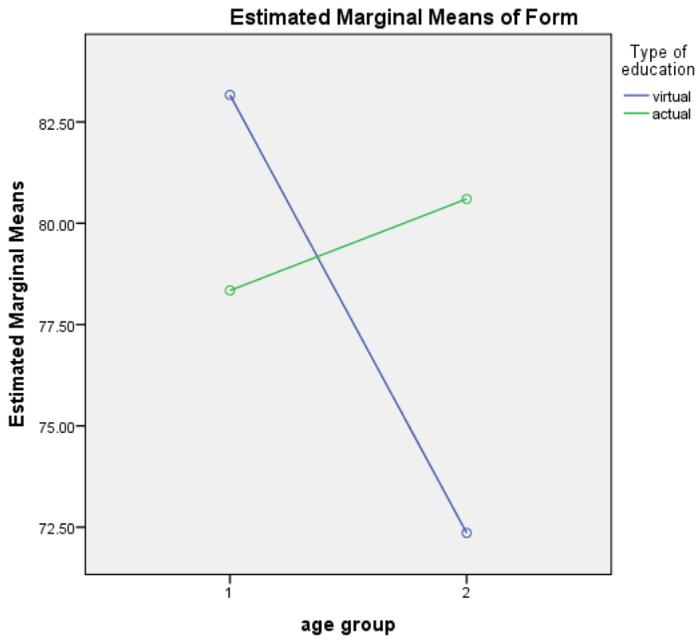


Figure 7

The effect of age and type of education on average score of the interns' survey questionnaire in each month (Form)

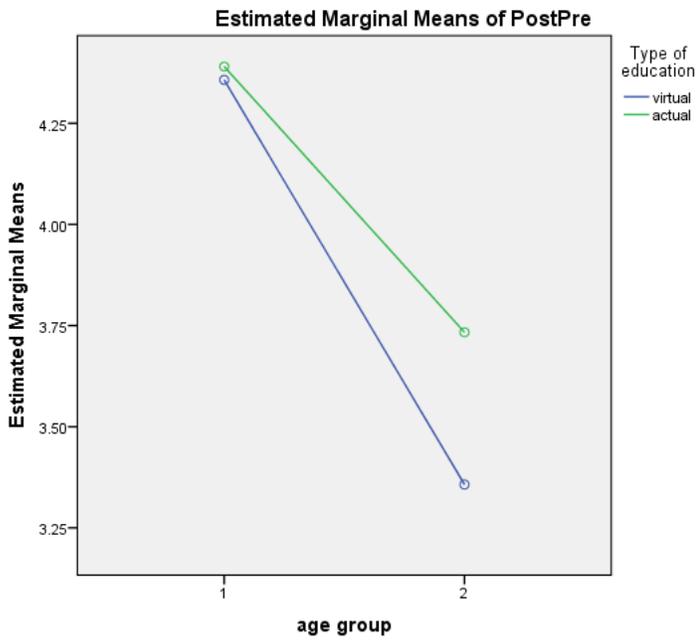


Figure 8

The effect of age and type of education on average score of differences between the post-test and pre-test in each session (PostPre)

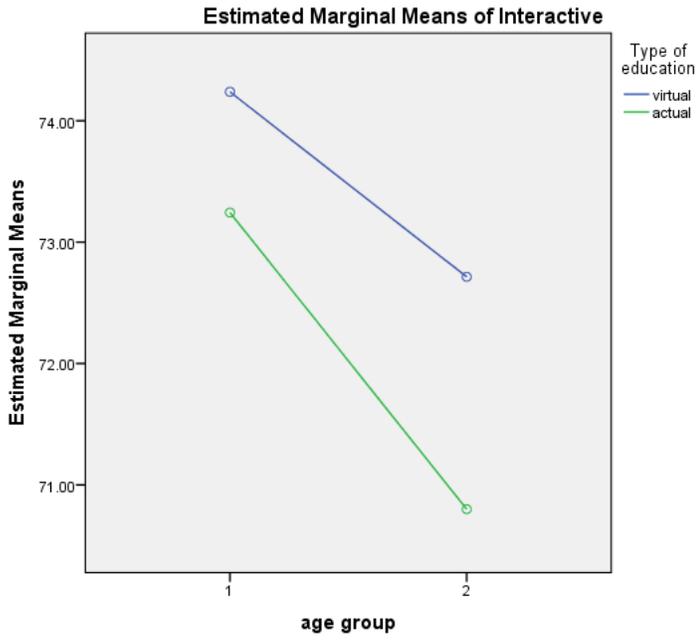


Figure 9

The effect of age and type of education on average score of 10 intervention tests per session (Interactive)

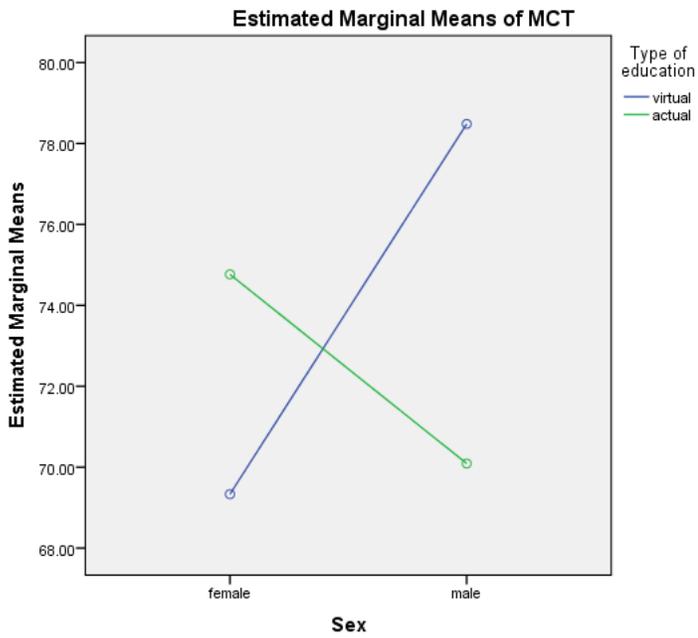


Figure 10

The effect of sex and type of education on average score of multiple choice theory test at the end of each month (MCT)

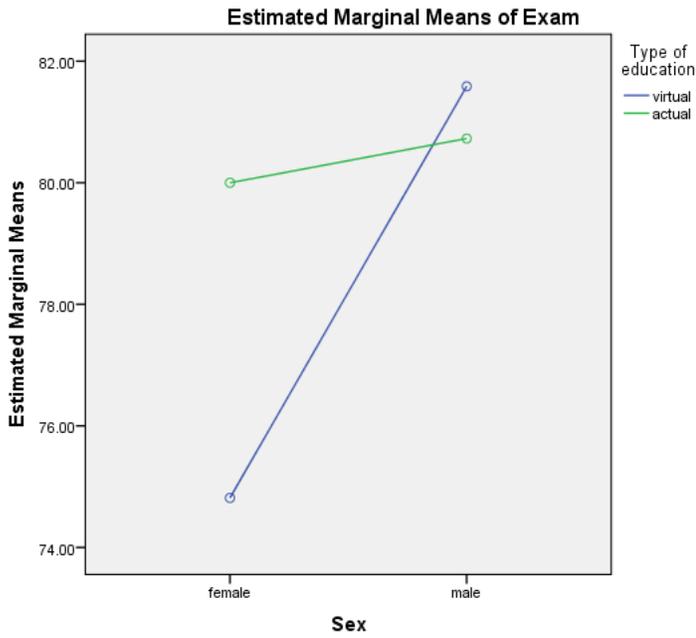


Figure 11

The effect of sex and type of education on average score of descriptive theory test at the end of each month (Exam)

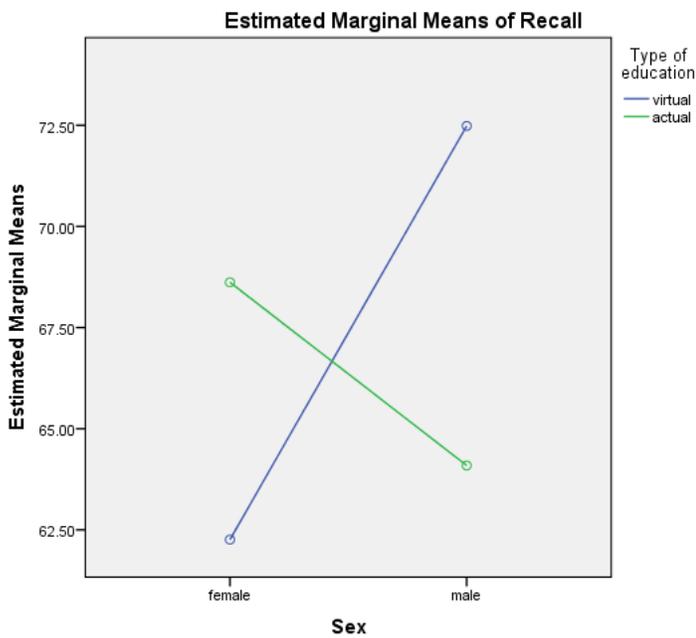


Figure 12

The effect of sex and type of education on average score of the recall test 10 days after the end of each month (Recall)

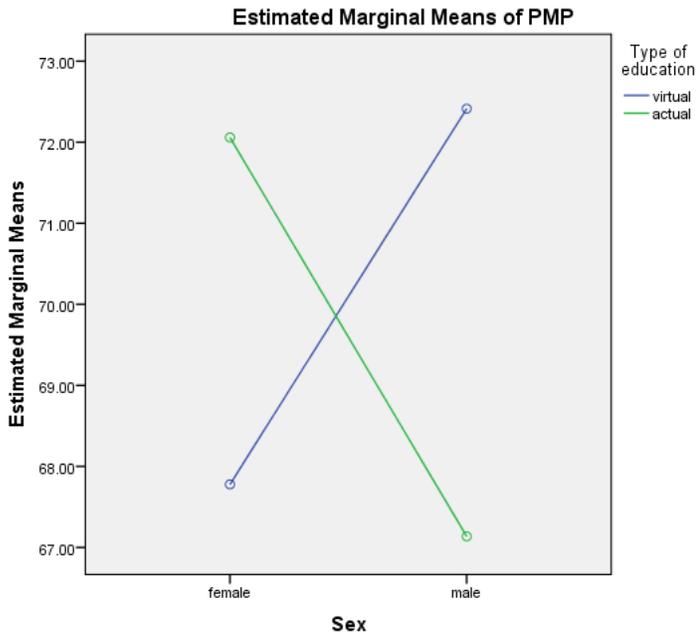


Figure 13

The effect of sex and type of education on average score of PMP theory test at the end of each month (PMP)

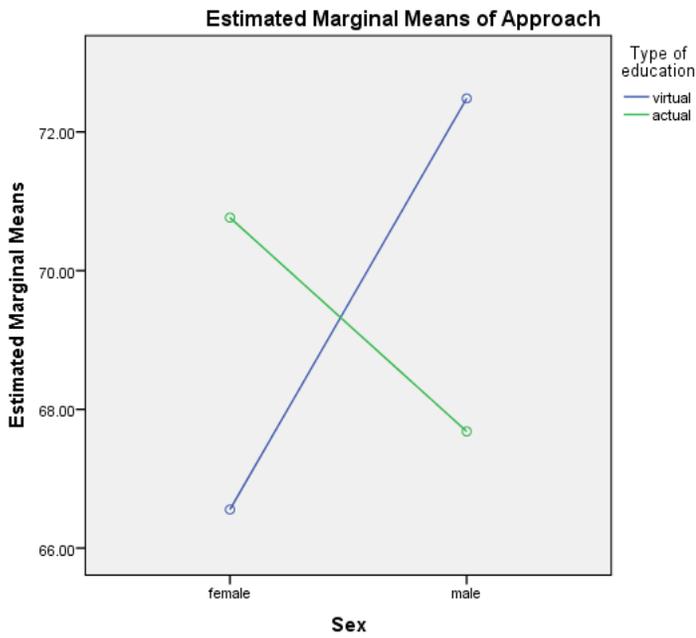


Figure 14

The effect of sex and type of education on average score of "approach to the patient" practical test based on the orders written by the interns on the patient's bedside in the emergency ward from the course content which is held monthly (Approach)

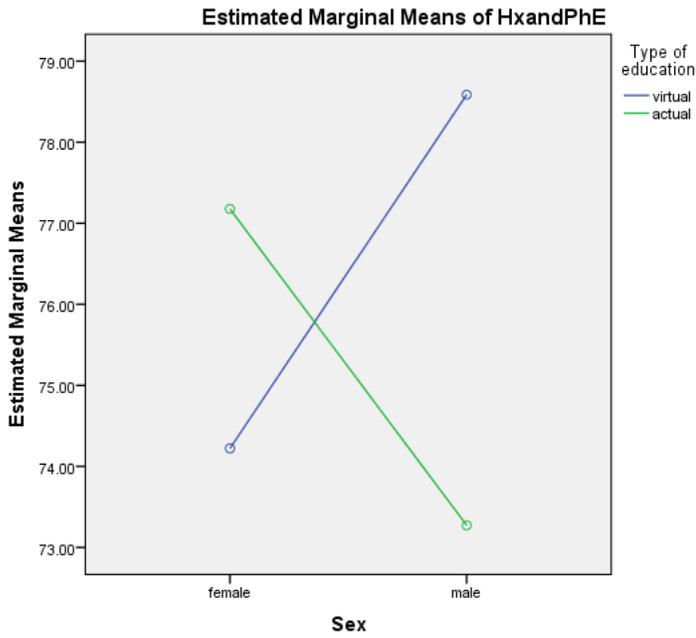


Figure 15

The effect of sex and type of education on average score of "Hx and Ph.E" practical test based on the history and examination performed by interns on the patient's bedside in the emergency ward which is held monthly (HxandPhE)

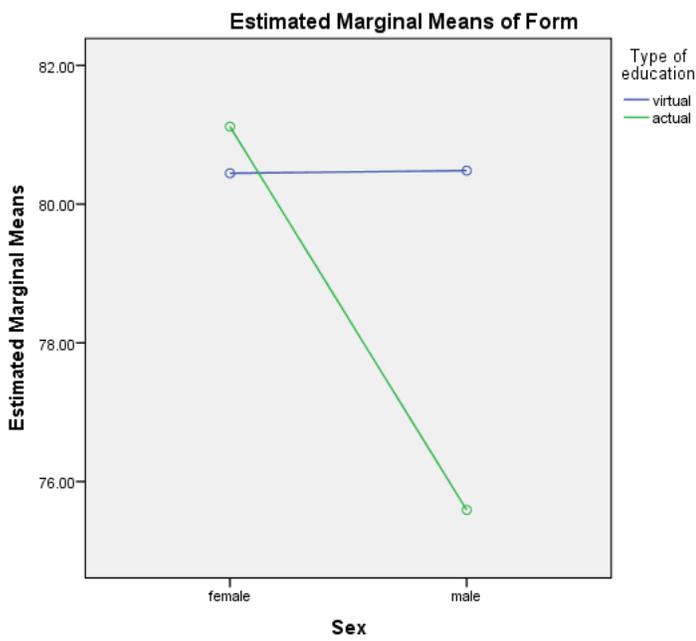


Figure 16

The effect of sex and type of education on average score of the interns' survey questionnaire in each month (Form)

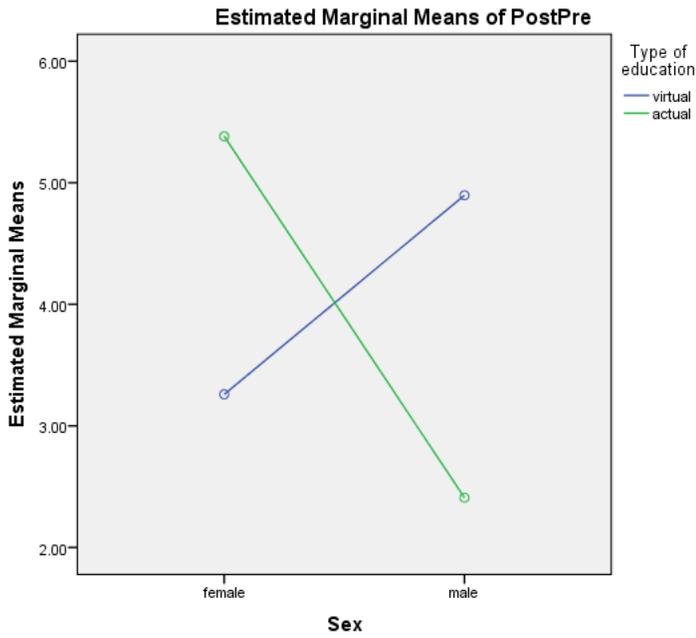


Figure 17

The effect of sex and type of education on average score of differences between the post-test and pre-test in each session (PostPre)

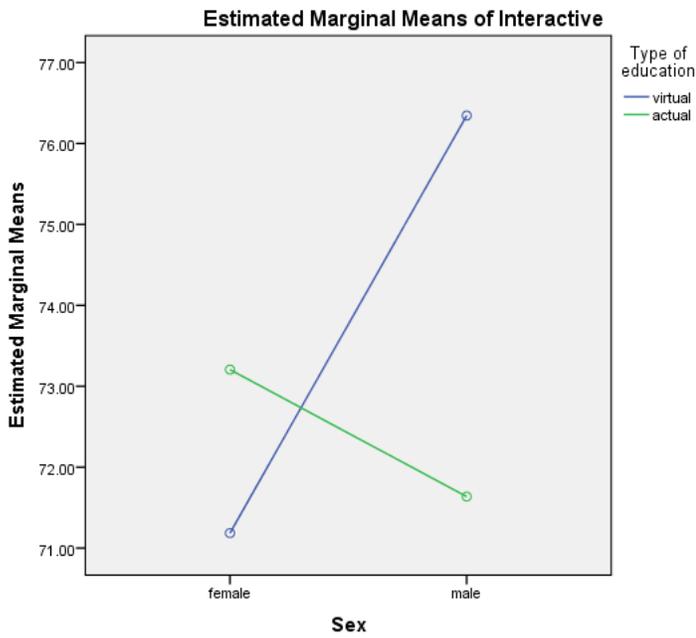


Figure 18

The effect of sex and type of education on average score of 10 intervention tests per session (Interactive)

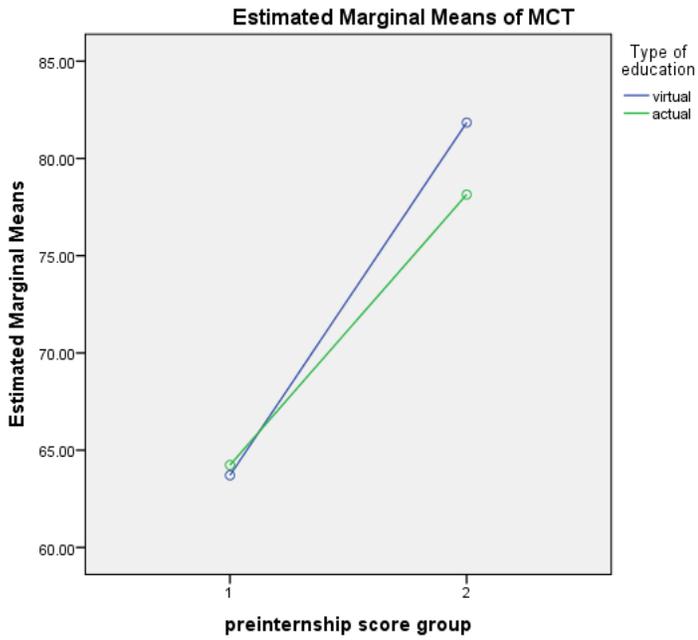


Figure 19

The effect of pre-internship score and type of education on average score of multiple choice theory test at the end of each month (MCT)

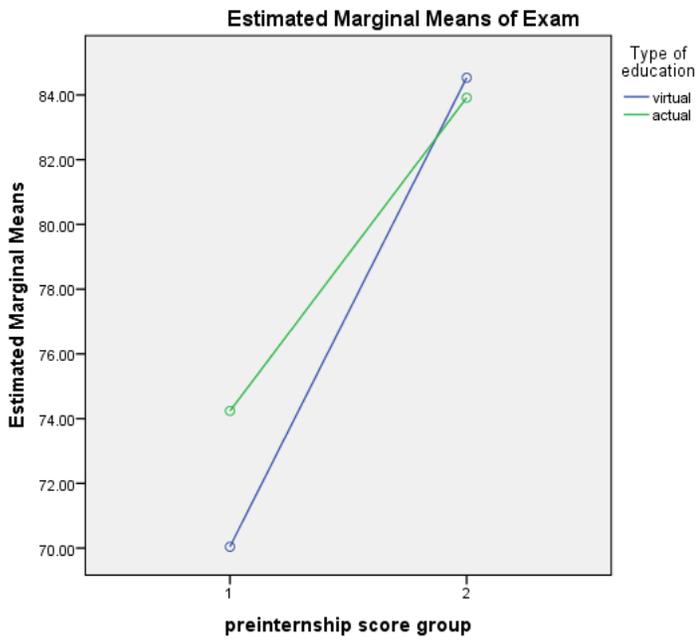


Figure 20

The effect of pre-internship score and type of education on average score of descriptive theory test at the end of each month (Exam)

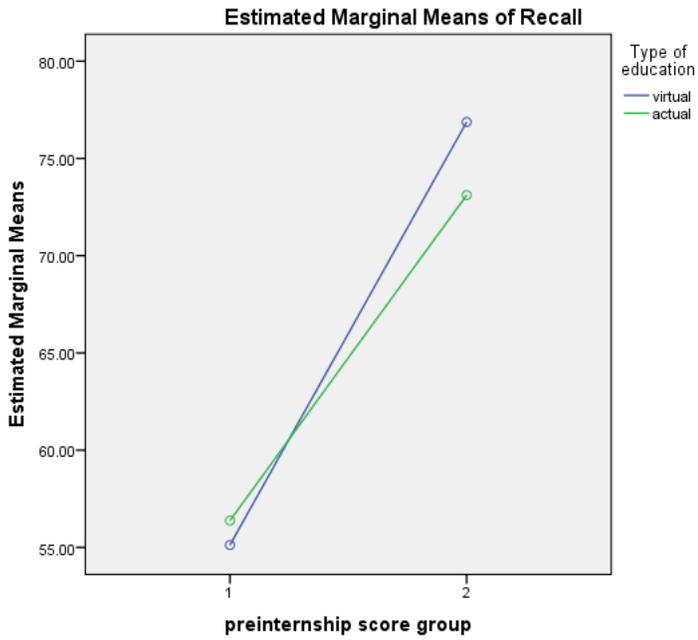


Figure 21

The effect of pre-internship score and type of education on average score of the recall test 10 days after the end of each month (Recall)

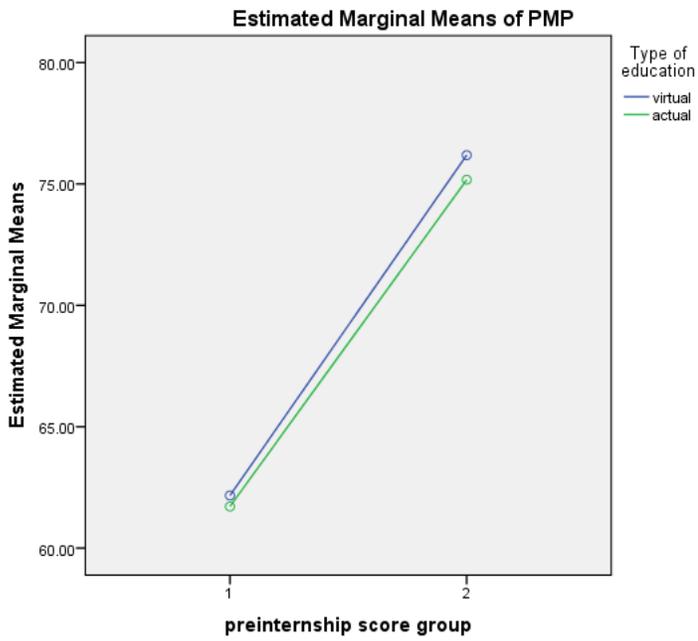


Figure 22

The effect of pre-internship score and type of education on average score of PMP theory test at the end of each month (PMP)

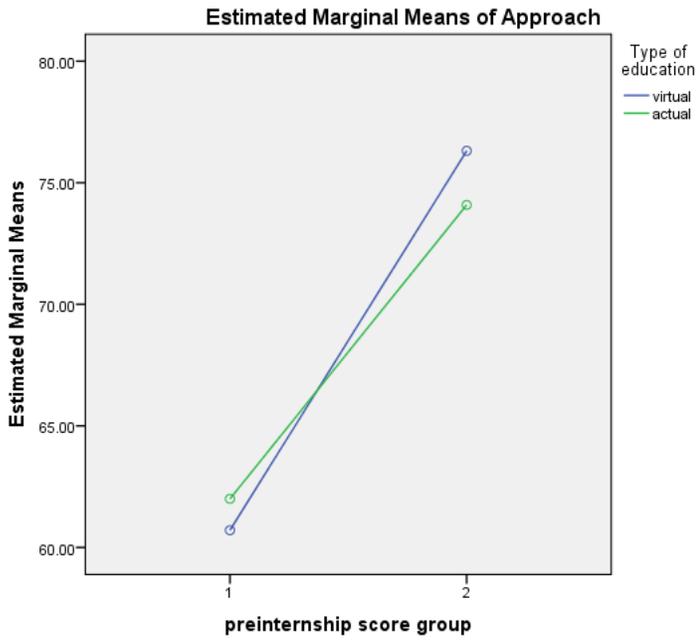


Figure 23

The effect of pre-internship score and type of education on average score of “approach to the patient” practical test based on the orders written by the interns on the patient’s bedside in the emergency ward from the course content which is held monthly (Approach)

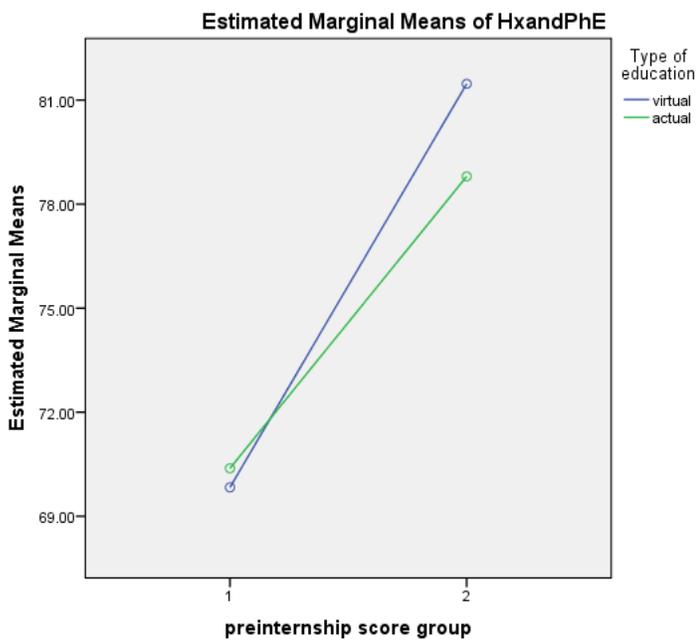


Figure 24

The effect of pre-internship score and type of education on average score of “Hx and Ph.E” practical test based on the history and examination performed by interns on the patient’s bedside in the emergency ward which is held monthly (HxandPhE)

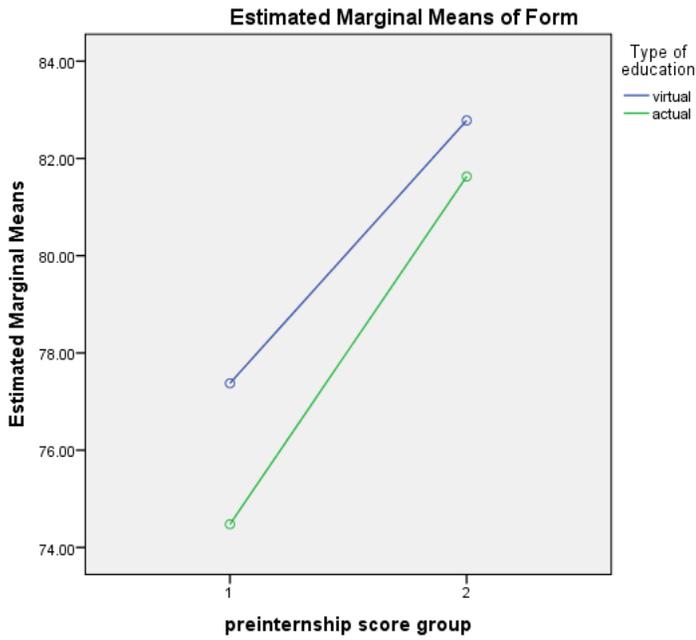


Figure 25

The effect of pre-internship score and type of education on average score of the interns' survey questionnaire in each month (Form)

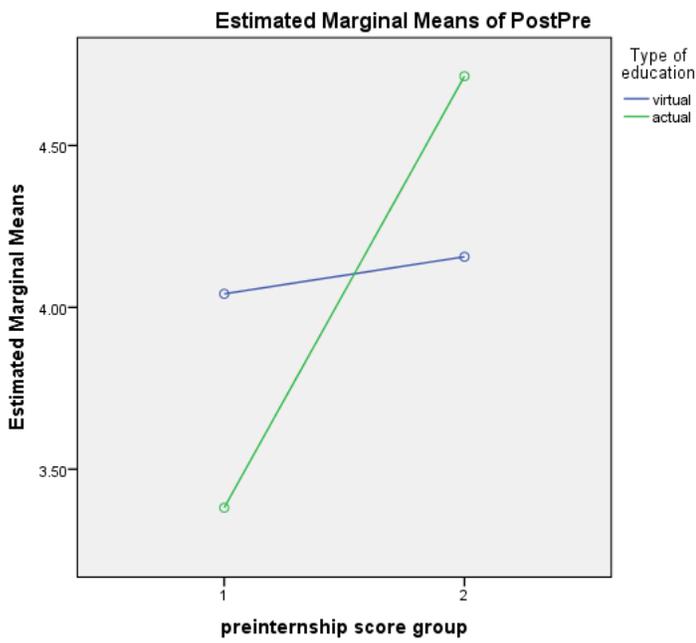


Figure 26

The effect of pre-internship score and type of education on average score of differences between the post-test and pre-test in each session (PostPre)

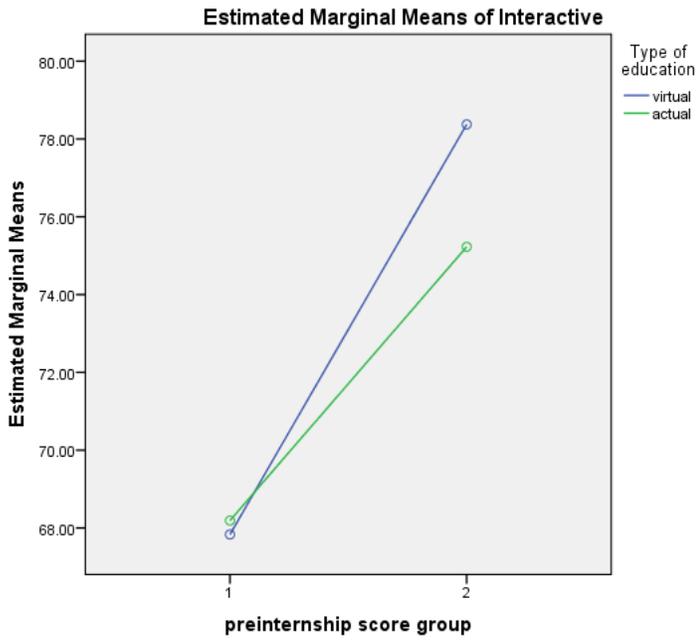


Figure 27

The effect of pre-internship score and type of education on average score of 10 intervention tests per session (Interactive)

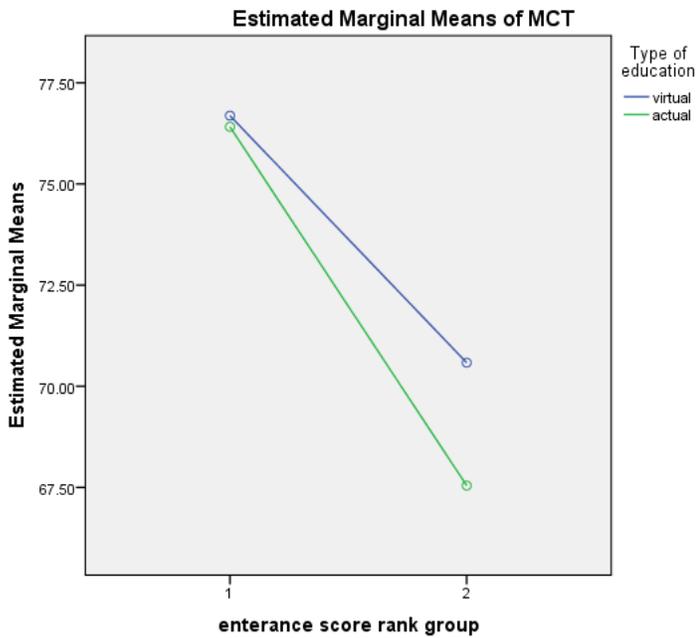


Figure 28

The effect of entrance score rank and type of education on average score of multiple choice theory test at the end of each month (MCT)

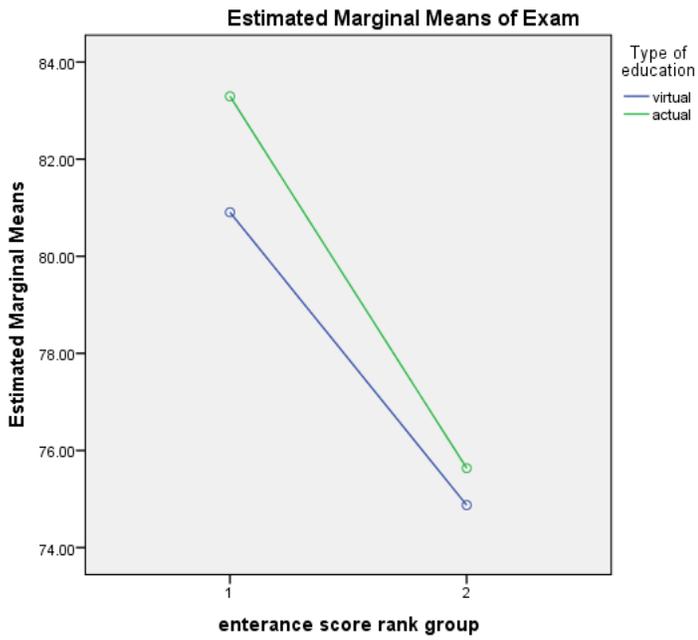


Figure 29

The effect of entrance score rank and type of education on average score of descriptive theory test at the end of each month (Exam)

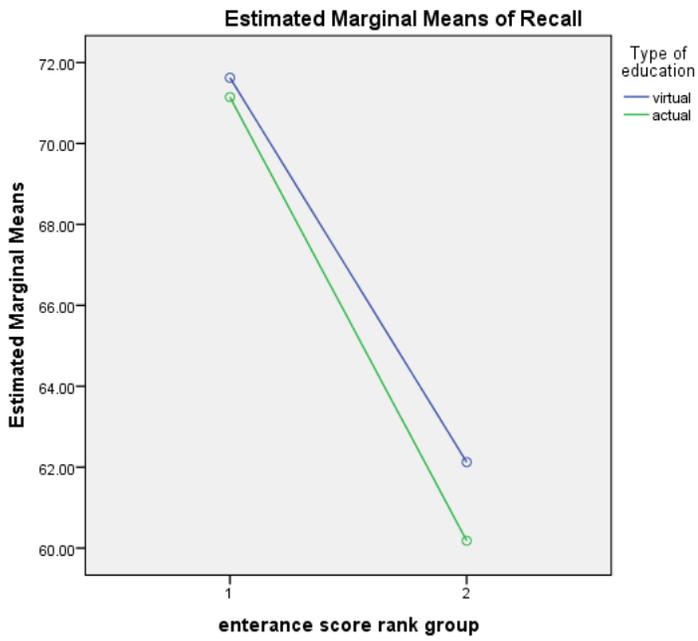


Figure 30

The effect of entrance score rank and type of education on average score of the recall test 10 days after the end of each month (Recall)

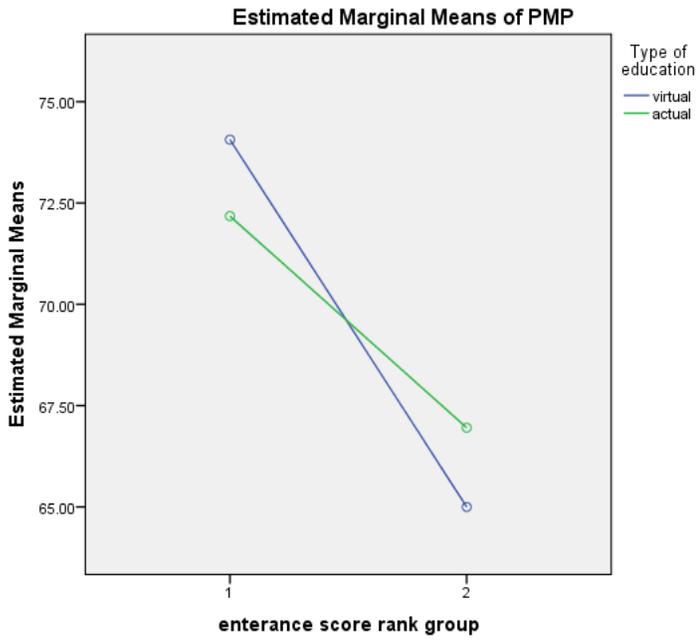


Figure 31

The effect of entrance score rank and type of education on average score of PMP theory test at the end of each month (PMP)

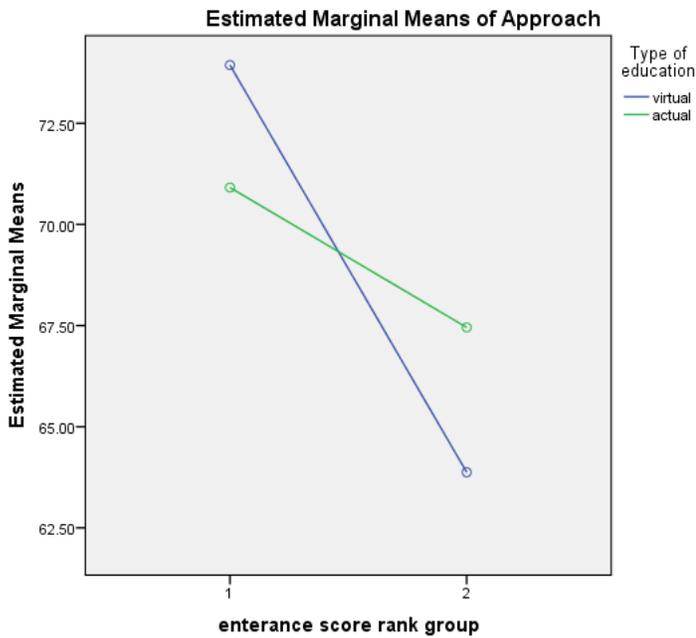


Figure 32

The effect of entrance score rank and type of education on average score of "approach to the patient" practical test based on the orders written by the interns on the patient's bedside in the emergency ward from the course content which is held monthly (Approach)

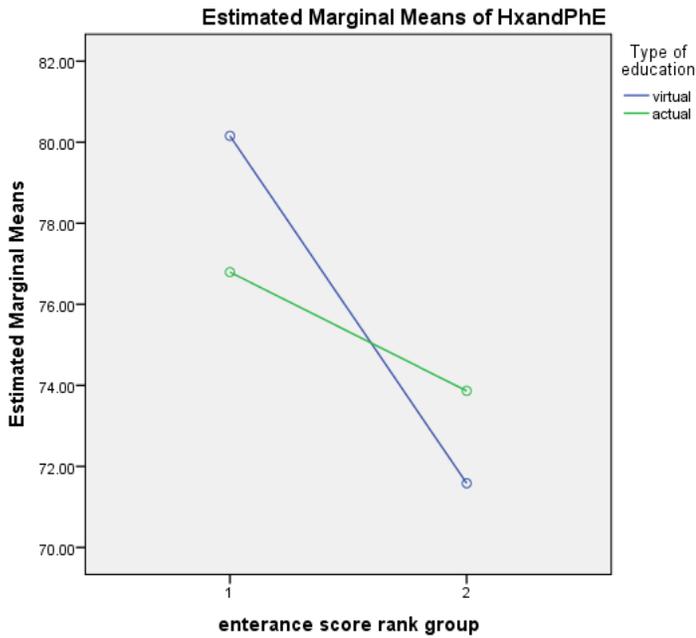


Figure 33

The effect of entrance score rank and type of education on average score of "Hx and Ph.E" practical test based on the history and examination performed by interns on the patient's bedside in the emergency ward which is held monthly (HxandPhE)

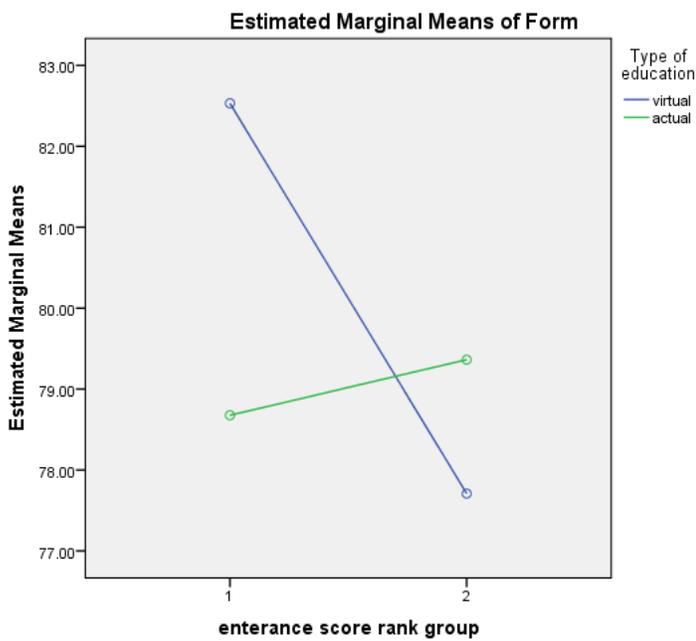


Figure 34

The effect of entrance score rank and type of education on average score of the interns' survey questionnaire in each month (Form)

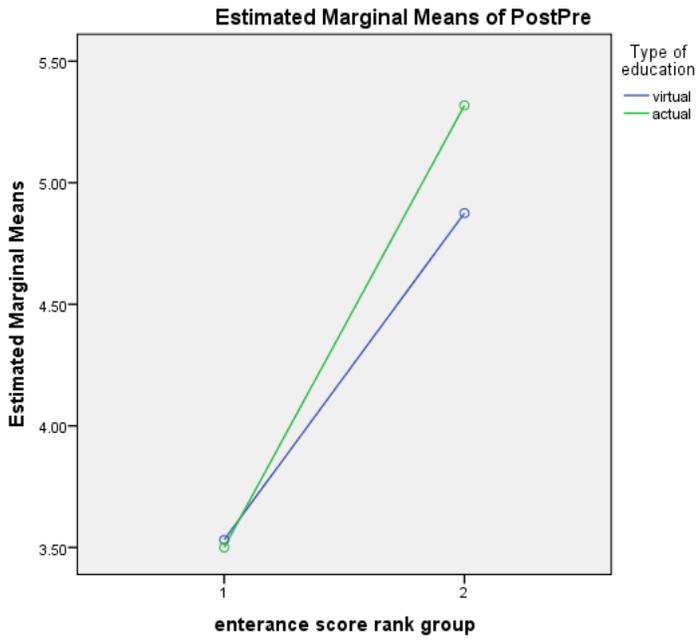


Figure 35

The effect of entrance score rank and type of education on average score of differences between the post-test and pre-test in each session (PostPre)

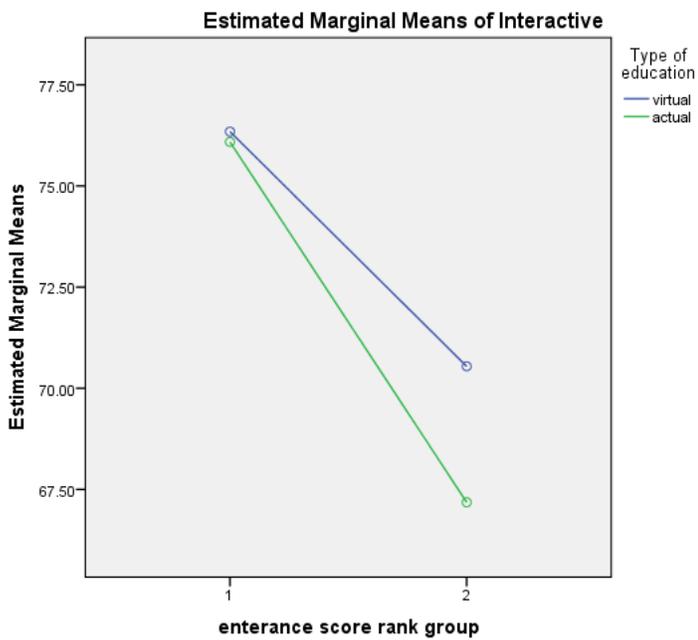


Figure 36

The effect of entrance score rank and type of education on average score of 10 intervention tests per session (Interactive)

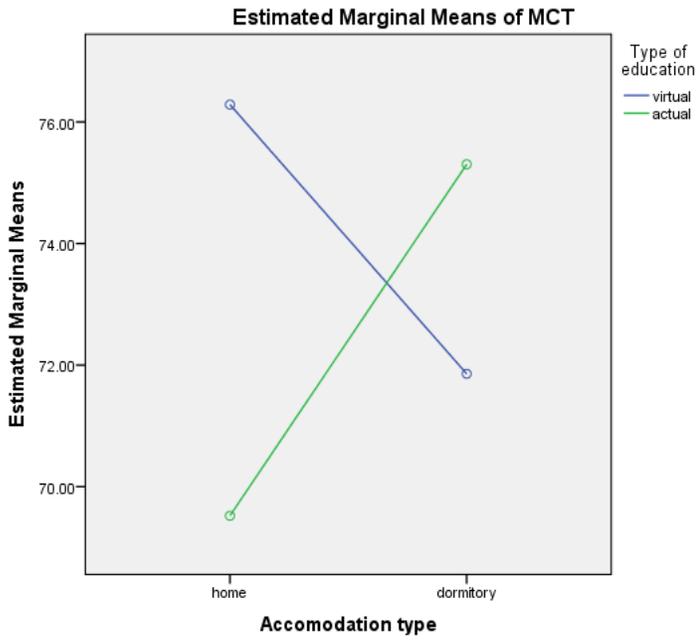


Figure 37

The effect of accommodation type and type of education on average score of multiple choice theory test at the end of each month (MCT)

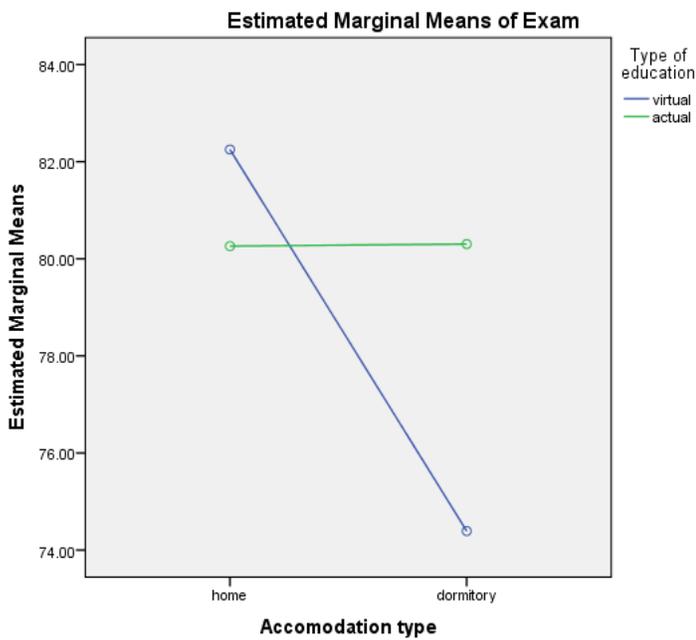


Figure 38

The effect of accommodation type and type of education on average score of descriptive theory test at the end of each month (Exam)

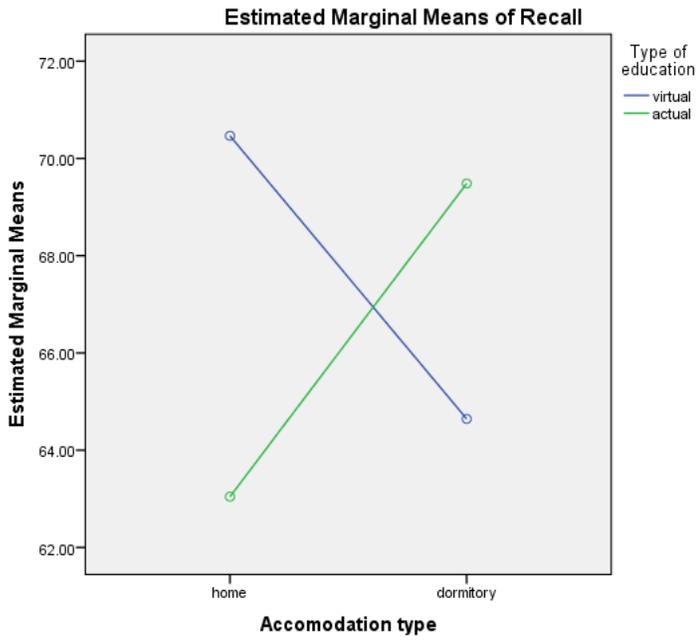


Figure 39

The effect of accommodation type and type of education on average score of the recall test 10 days after the end of each month (Recall)

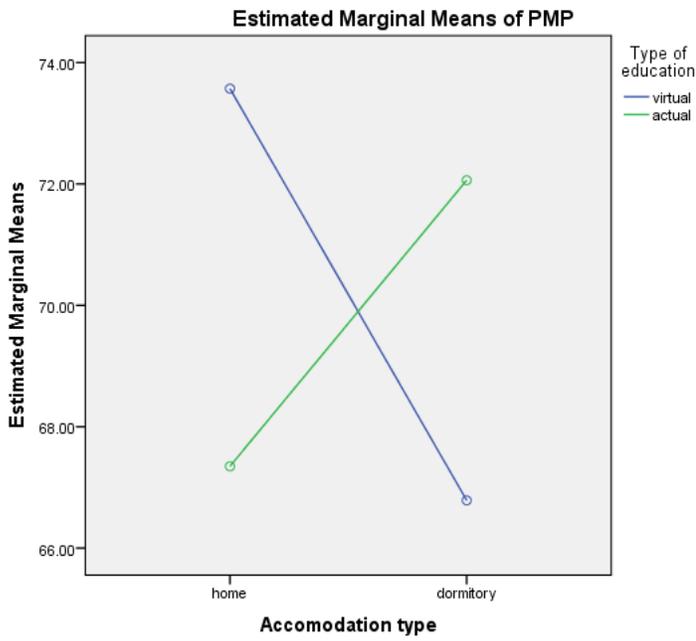


Figure 40

The effect of accommodation type and type of education on average score of PMP theory test at the end of each month (PMP)

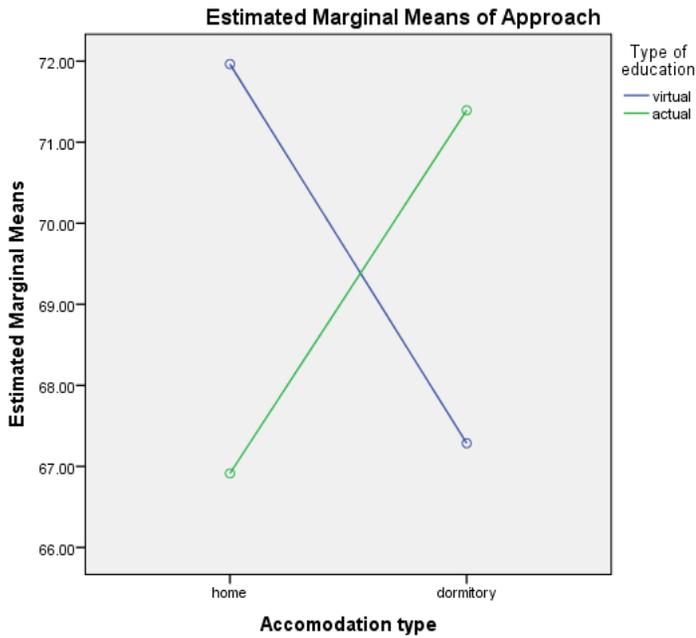


Figure 41

The effect of accommodation type and type of education on average score of “approach to the patient” practical test based on the orders written by the interns on the patient’s bedside in the emergency ward from the course content which is held monthly (Approach)

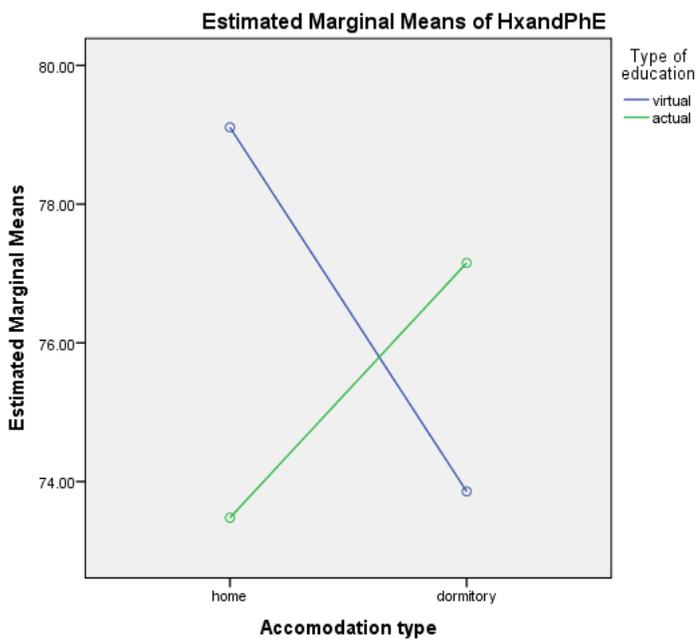


Figure 42

The effect of accommodation type and type of education on average score of “Hx and Ph.E” practical test based on the history and examination performed by interns on the patient’s bedside in the emergency ward which is held monthly (HxandPhE)

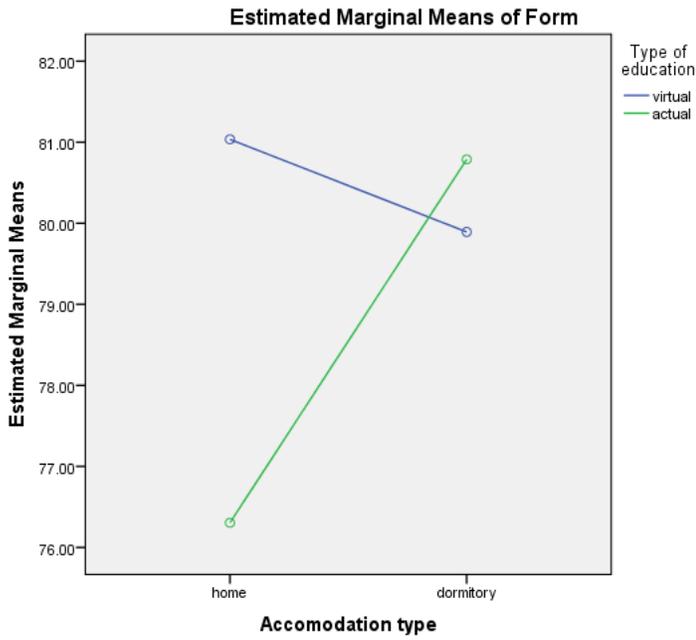


Figure 43

The effect of accommodation type and type of education on average score of the interns' survey questionnaire in each month (Form)

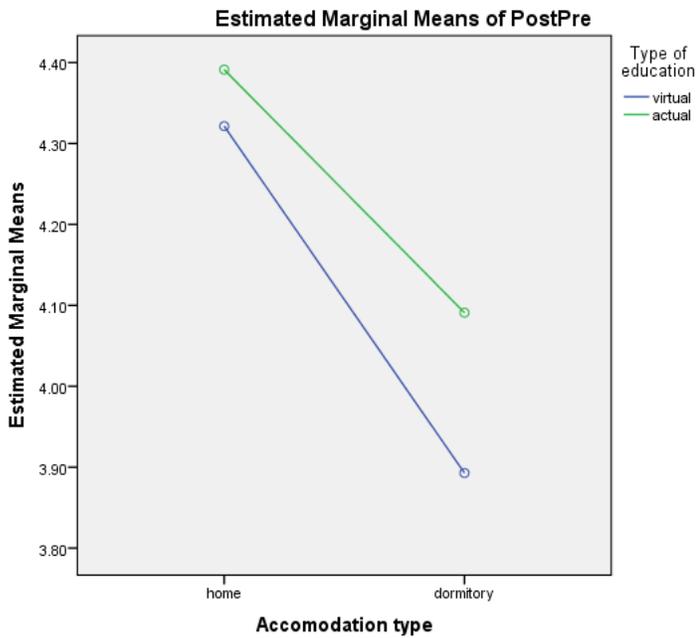


Figure 44

The effect of accommodation type and type of education on average score of differences between the post-test and pre-test in each session (PostPre)

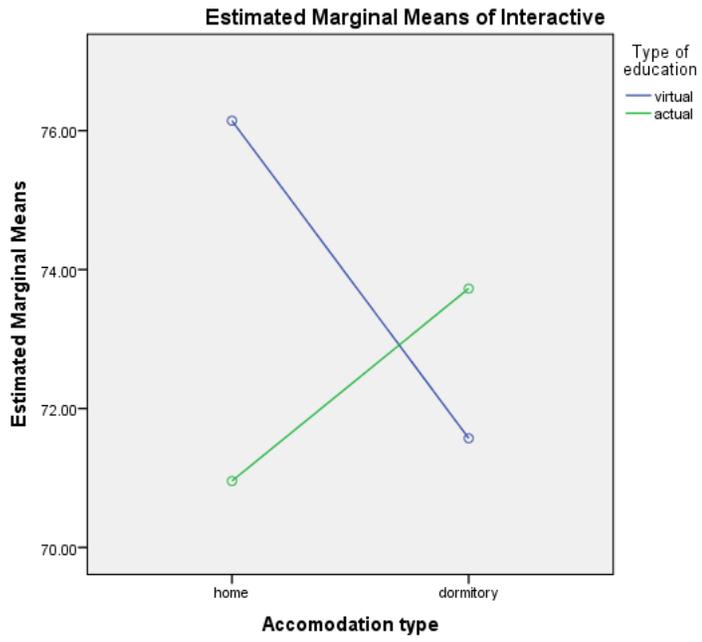


Figure 45

The effect of accommodation type and type of education on average score of 10 intervention tests per session (Interactive)