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Evaluating the educational environment of an international animal model-based wet lab course for undergraduate students

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HIGHLIGHTS

- ESMSC is an International Surgical Science and Wet Lab course aimed at undergraduates.
- Students seem to positively rate the ESMSC educational environment.
- Year 3/4 Students have a significantly positive "Perception of Learning", when compared to Year 5/6.
- KCL Students gave a more feedback on the course compared to their Greek counterparts.
- Further research should focus on involving and motivating students early in BST.

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ABSTRACT

Background: Essential Skills in the management of Surgical Cases – ESMSC is an International Combined Applied Surgical Science and Wet Lab course aimed at the undergraduate level. ESMSC combines interactive basic science workshops and case-based learning, with basic surgical training modules (BST) on Ex Vivo and In Vivo swine model. In Vivo Dissections include more advanced modules i.e. Abdominal Anatomy Dissections and Cardiac Transplant.

Aim: To evaluate the educational environment of a novel course, as well as to compare Medical students' perceptions across various groups.

Materials and Methods: 83 Delegates from King's College London (KCL) and several Hellenic Medical Schools attended the ESMSC course. The DREEM inventory was distributed upon completion of the modules.

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Results: The mean overall score for DREEM inventory was 148.05/200(99–196, SD = 17.90). Cronbach's Alpha value was 0.818, indicating good internal consistency of the data. Year 3/4 Students have a significantly positive "Perception of Learning", when compared to Year 5/6 (36.43 vs. 33.75, p = 0.017). KCL Students have a more positive view of the course compared to their Greek counterparts (155.19 vs. 145.62/200, p = 0.034). No statistical significant difference was noted when comparing male vs. female students (p > 0.05).

Conclusions: Students seem to positively rate the ESMSC educational environment. Junior as well as KCL students appear to be more enthusiastic. Further research should focus on the optimal strategy for early involvement and motivation of various students' groups in BST.

1. Introduction

The educational environment is considered to be a crucial parameter that reflects directly onto the students' satisfaction, academic aspirations and overall perception of well-being [1]. It is important to note that, most of the curricula are shifting toward a student-centered pattern, where evaluation of the educational environment has been possible through various tools, that aim to objectively measure various parameters [1–3]. Recent evolution in Medical Education, diversity in the personality of Medical Students, as well as occasional misinterpretation by teachers of students' perceptions regarding the educational environment [4], have underlined the need of effective evaluation of the latter [1]. Apart from the educational environment's role in students' learning [5–7], its continuous evolving character, sets the need for an objective, unbiased tool to assess the impact of various changes directly onto the educational process.

Various tools have been designed to assess educational environment [8,9]. The Dundee Ready Education Environment Measure (DREEM) [10–12] is a validated 50-statement questionnaire, which is used to effectively evaluate the educational environment. The overall evaluation is based on the aggregate scores, as well as the 5 subscales, and many authors include and comment on each of the 50 statements individually [1,13]. DREEM inventory has been used to evaluate various educational environments [1,4,13–29], mainly in undergraduate curricula, as well as postgraduate training [30].

Although some studies question the 5 factor structure of DREEM [13,31], Soemantri et al. [8] conducted a systematic review on various tools, and concluded that DREEM is the most comprehensive measure of the educational environment. Nevertheless, Miles et al. [1] notes in their systematic review, that despite DREEM being an effective tool, consensus on statistical analysis and interpretation of the finding s should be reached to avoid misconceptions.

Essential Skills in the Management of Surgical Cases – ESMSC [32] is an International Combined Applied Surgical Science and wet lab course aimed specifically at the undergraduate level. It combines basic science workshops (ABGs, ECG, Shock), case-based learning on various surgical cases with basic surgical skills (BST) training on ex vivo and in vivo swine modules. In Vivo Dissections involve various basic and more advanced modules on swine model. Delegates also have the chance to be actively involved in the Cardiac Explantation under bypass In Vivo experiment as well. Ex Vivo stations include basic suturing, fundamental laparoscopic skills (FLS), Open Reduction Internal Fixation (ORIF) of long bone fractures, wound debridement and tendon repair. The unique component of ESMSC curriculum lies in the mixture of high-fidelity In Vivo SBL, with other wet or dry lab lower fidelity modules with Basic and Applied Surgical Science interactive workshops. It also offers a unique opportunity for exchange of ideas between various educational background delegates as well as faculty members and it involves, motivates and inspires students at an early stage to pursue a surgical career.

In the context of developing a novel, international, two-day course, involving intense basic, as well as more advanced skills-based training, we considered it essential to objectively evaluate the educational environment using DREEM questionnaire.

2. Aims

The primary aim of this study is to evaluate the overall educational environment of a novel international wet lab course (ESMSC). Additionally, we wanted to compare the overall and the subscale scores among different groups of students.

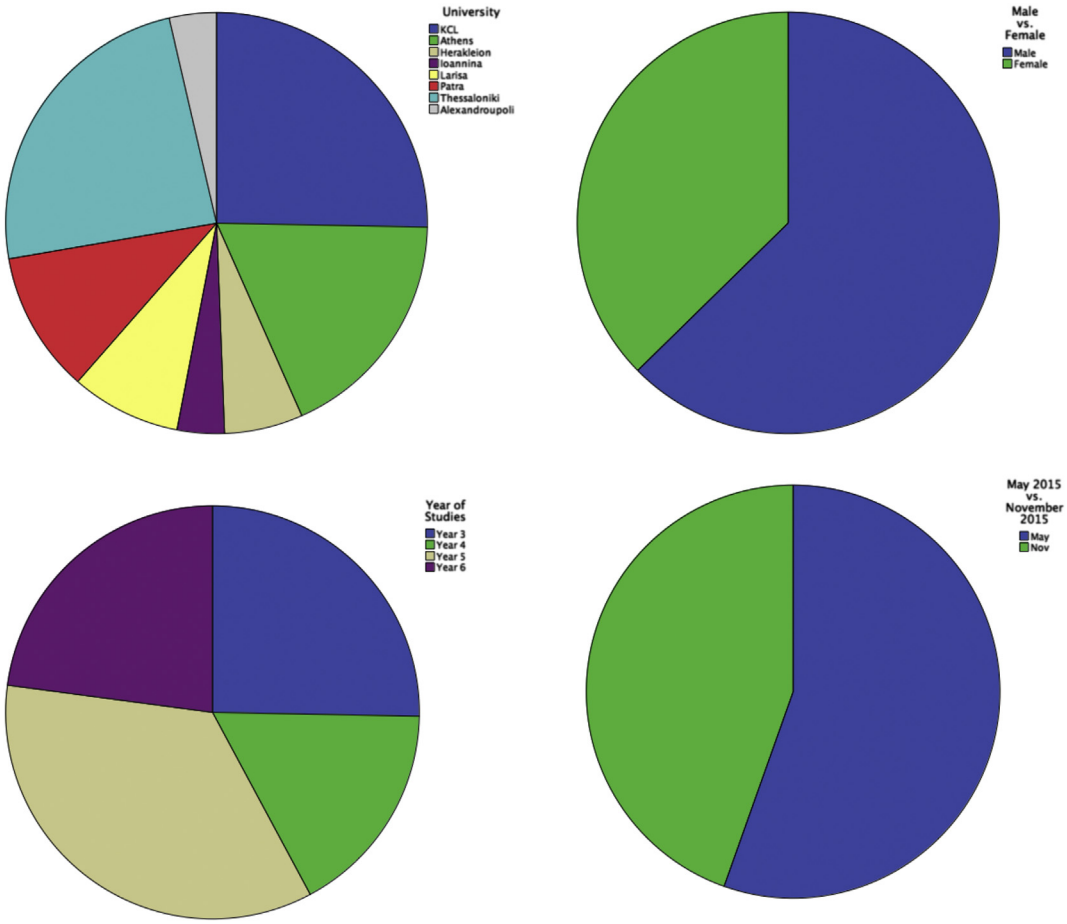
3. Materials and Methods

Delegates from the UK (King's College London), as well as Greek Medical Schools register their interest to attend the ESMSC course online (esmsc.gr). Selection of participants is performed via our online portal, based on CV criteria including number of publications, presentations in conferences etc. A relevant statement, where participants advocate their interest and motivation towards a surgical career, is attached to the application. The application, as well as the course is run in English, and good operational command of the language is mandatory. A panel of two senior faculty members independently assesses the applications. This is to assure that the best candidates are selected, while at the same time, homogeneity, in terms of previous exposure and background knowledge, is still maintained. This was performed on the basis to eliminate selection bias i.e. selecting only very competent students. With regards to the faculty members, all of them are proficient or native English speakers and comprise from junior to senior trainees as well as Consultants and Academics from the UK, Greece or other various countries from the EU and abroad. The ratio between delegates and faculty members is almost 1:1 to ensure highest quality teaching is assured.

Delegates were asked to fill the DREEM inventory anonymously, in the teaching room, immediately following completion of the ESMSC. Data on Demographics (Age and Sex), as well as Medical School and Year of Studies were recorded and demonstrated in Graph 1.

Reliability analysis, using Cronbach's Alpha coefficient, was performed to evaluate internal consistency of the DREEM. Acceptable level of internal consistency was considered if Cronbach's Alpha is between 0.5 and 0.7, and good level if above 0.7 [33]. Interclass Correlation Coefficient (ICC) was used to evaluate the level of agreement between measurements. ICC<0.2 is considered as poor agreement, 0.21–0.40 as fair, 0.61–0.80 as good and 0.81–1.0 as very good.

Scoring, as well as Interpretation of the DREEM inventory was



Graph 1. Demographics of Sample used.

based on the practical guide. A 5-point Likert-type scale, ranging from Strongly Agree (SA, 4) to Strongly Disagree (SD, 0) was used for positive statements. With regards to negative statements (Questions 4, 8, 9, 17, 25, 35, 39, 48 and 50), the scale ranged from Strongly Agree (SA, 0) to Strongly Disagree (SD, 4).

The overall score, as well as the five subscale scores were used to evaluate the ESMSC educational environment. Subscale scores include "Registrars perception of Learning (RPoL)", "Registrars Perception of Course Designers (RPoCD)", "Registrars' Academic Self-Perception (RASP)", "Registrars' Perception of Atmosphere (RPoA)" and "Registrars' Social Self Perceptions (RSSP)".

3.1. Statistical analysis

Statistical analysis of our results was performed using IBM SPSS for Macintosh version 22 (Armonk, NY, IBM Corp.). Normality of distribution for was assessed based on Shapiro-Wilk test. Independent *t*-test associations were used to compare means in various groups (Year 3/4 vs. Year 5/6 Students, KCL vs. Greek Students, Male vs. Female, May 2015 vs. November 2015 cohorts). One-way ANOVA was performed to compare the mean scores between Year 3–6 Medical Students, as well as between students from various Universities. Statistical significant level was set at $p = 0.05$.

4. Results

89 delegates attended the course and 83 filled out the DREEM inventory anonymously (response rate 83/89, 93.2%). N = 46 had attended the course in May 2015 (55.4%), whereas N = 37(44.6%) in November 2015. 52 delegates (62.7%) were Male students and 31 (37.3%) female. The mean age was 23.38 years old (20–30, SD = 1.73) (Graph 1).

21 (25.3%) came from King's College London, and 62 (74.7%) from Hellenic Medical Schools. With regards to Hellenic Medical Schools, N = 15 (18.1%) were students from Athens Medical School, N = 5(6.0%) from Herakleion University, N = 3(3.6%) from Ioannina University, N = 7(8.4%) from Larisa University, N = 9(10.8%) from Patra University, N = 20(24.1%) from Thessaloniki University and N = 3(3.6%) from Alexandroupoli University (Graph 1).

Concerning the Year of Studies, N = 21 (25.3%) were Year 3 Students, N = 14 (16.9%) Year 4, N = 29(34.9%) Year 5 and N = 19 (22.9%) Year 6. In total, N = 35 (42.2%) were Year 3 or 4 and classified as Junior Medical Students, whereas N = 48 (57.8%) were Year 5 or 6 classified as Senior or Final Year Medical Students. In the UK clinical rotation starts at the 3rd Year, whereas in Greece, the equivalent Year is the 4th. What is more, UK MBBS is a 5 Year course, whereas in Greece the duration of the undergraduate studies is 6 years (Graph 1).

Overall Cronbach's Alpha Coefficient value was 0.818, which indicates good level of internal consistency for DREEM questionnaire. Cronbach's Alpha value for RPoL was 0.899, for RPoCD 0.766, for RASP 0.772, for RPoA 0.770, and for RSSP 0.812, which indicate good internal consistency for all the sub-scales. Overall ICC value was 0.818, which is deemed as very good level of agreement[33]. Shapiro-Wilk normality test showed normal distribution for overall and all subscale scores ($p > 0.05$) except RPoA ($p = 0.014$), though

this was considered as normal using the Kolmogorov-Smirnov test ($p = 0.20$).

The mean overall score for the DREEM inventory was 148.05/200(99–196, SD = 17.90), which is classified as "More Positive than Negative" (Table 1). With regards to subscale mean scores, "Registrars' Perception of Learning" scored 34.88/48(23–48, SD = 5.01), which is interpreted as "A more positive perception". "Registrars' Perception of Course Organizers" mean score was 33.89/44(21–44, SD = 4.70), which corresponds to "Moving in the right direction". "Registrars' Academic Self Perception" scored 23.15/32(13–32, SD = 3.59) which is interpreted as "Feeling on the Positive Side". "Registrars' Perception of Atmosphere" mean score was 36.73/48(17–47, SD = 4.93) which is interpreted as "A good feeling overall". Finally, "Registrars' Social Self Perceptions" mean score was 19.28/28(12–27, SD = 2.95), which is classified as "Not too bad" (Table 2). Individual Question Scores are listed on Table 1.

Table 1
Mean Scores for each Question (1–50).

Question	N	Minimum	Maximum	Mean	Std. deviation
1	83	0.00	4.00	3.3855	0.71280
2	83	2.00	4.00	3.4578	0.61090
3	83	0.00	4.00	2.7108	0.86292
4	83	0.00	4.00	2.5301	1.01618
5	83	1.00	4.00	2.7952	0.61997
6	83	1.00	4.00	2.9518	0.71403
7	83	1.00	4.00	3.1928	0.75640
8	83	0.00	4.00	3.0120	1.01806
9	83	0.00	4.00	2.6988	1.04456
10	83	1.00	4.00	3.2289	0.70409
11	83	1.00	4.00	3.2169	0.68161
12	83	0.00	4.00	2.5060	1.11938
13	83	1.00	4.00	2.6265	0.86547
14	83	0.00	4.00	2.4458	1.20216
15	83	0.00	4.00	3.2892	0.83418
16	83	0.00	4.00	3.1446	0.78294
17	83	0.00	4.00	2.9759	0.99971
18	83	0.00	4.00	3.0602	0.75465
19	83	0.00	4.00	3.2892	0.84867
20	83	2.00	4.00	3.3133	0.53937
21	83	0.00	4.00	2.7349	0.91177
22	83	1.00	4.00	2.9880	0.86241
23	83	1.00	4.00	3.2530	0.62163
24	83	1.00	4.00	2.9518	0.88212
25	83	0.00	4.00	1.7590	1.03111
26	83	1.00	4.00	2.7590	0.79003
27	83	0.00	4.00	2.3253	0.97666
28	83	0.00	4.00	2.3012	1.28533
29	83	0.00	4.00	2.8193	0.79854
30	83	1.00	4.00	3.0120	0.75698
31	83	1.00	4.00	2.5904	0.91113
32	83	0.00	4.00	2.6747	0.95136
33	83	1.00	4.00	3.2771	0.61114
34	83	1.00	4.00	3.2530	0.55969
35	83	0.00	4.00	3.2892	0.89074
36	83	0.00	4.00	2.7711	0.68655
37	83	1.00	4.00	3.1084	0.58460
38	83	1.00	4.00	3.0723	0.71197
39	83	1.00	4.00	3.4699	0.73811
40	83	1.00	4.00	3.3253	0.58661
41	83	0.00	4.00	2.7831	0.91129
42	83	0.00	4.00	3.1446	0.76720
43	83	1.00	4.00	3.1807	0.66524
44	83	1.00	4.00	3.2651	0.64552
45	83	1.00	4.00	3.3253	0.66458
46	83	0.00	4.00	3.1807	0.88545
47	83	1.00	4.00	2.7229	0.88777
48	83	0.00	4.00	2.7108	0.89074
49	83	0.00	4.00	3.3133	0.67945
50	83	0.00	4.00	2.8554	0.98936
Total Score	83	99.00	196.00	148.04	17.90

The minimum mean score was recorded for item 25 "The teaching over emphasizes factual learning" (mean = 1.76, 1–5, SD = 1.03), and the maximum for item 39 "The course organizers get angry in teaching sessions", (mean = 3.46, 1.00–4.00, SD = 0.73) (Table 1).

Attempting a comparison between the May vs. the November Cohorts of Students, there was no statistical significant difference in the mean overall score nor in any of the sub-scale scores ($p > 0.05$ for all associations).

Comparing Year 3/4 vs. Year 5/6 Students there was no statistically significant difference in the overall DREEM inventory score, though it was higher for Year 3/4 Students (151.77 vs. 145.33, $p = 0.114$). However, there was a statistically significant higher score for Year 3/4 Students in terms of "Registrars' Perception of Learning" (36.43 vs. 33.75, $p = 0.017$), (Table 3). ANOVA analysis revealed that Year 3 students recorded the highest mean sub-scale and overall scores compared to any other group, and that there was an overall tendency for lower DREEM scores with advancing medical school year seniority, though this did not reach statistical significance ($p > 0.05$) (Table 4).

When comparing KCL vs. the 7 Hellenic Medical Schools, there seems to be a difference in the overall mean DREEM inventory score: 155.19 vs. 145.62/200 ($p = 0.034$). In terms of subscale scores, there was a statistically significant difference in the mean scores of "Registrars' Perception of Learning" (KCL vs. Greek, 37.9 vs. 33.85 respectively, $p = 0.003$), as well as in "Registrars Social Perceptions" (KCL vs. Greek, 20.43 vs. 18.89, $p = 0.05$) (Table 5). One-way ANOVA analysis confirmed that KCL students had the highest mean overall score ($p = 0.002$), as well as sub-scale scores (RPoL, $p = 0.015$, RPoCO, $p = 0.073$, RASP, $p = 0.003$, RPoA, $p = 0.001$, RSSP, $p = 0.019$), compared to the 7 Hellenic Medical School Students (Table 6).

Male Medical Students reported a higher mean overall DREEM score vs. Female Students (149.29 vs. 145.97, $p = 0.434$), though it did not reach statistical significance. No other statistical significant differences were noted within the rest of the DREEM subscale evaluation.

5. Discussion

Educational environment is undoubtedly a vital parameter [1] that reflects directly onto the students' learning [5–7,34]. Introducing ESMSC as a novel course [32] automatically generates the need for an objective assessment of students' perception on the actual educational environment. Furthermore, the ESMSC curriculum consists of a variety of in vivo and ex vivo hands-on modules, with basic science workshops and lectures, which is considered as a

Table 2
Mean scores for each subscale.

	N	Minimum	Maximum	Mean	Std. deviation
Registrar's perception of learning	83	23.00	48.00	34.8795	5.00584
Registrars' perception of course organizers	83	21.00	44.00	33.8916	4.70343
Registrars' academic self perception	83	13.00	32.00	23.1566	3.59363
Registrars' perceptions of atmosphere	83	17.00	47.00	36.7349	4.92649
Registrars' social self perceptions	83	12.00	27.00	19.2771	2.94798

Table 3
Comparison between Year 3–4 vs. Year 5–6.

		P value	Mean	Std. deviation	Std. error mean
DREEM overall score	Senior	0.114	145.3333	16.71963	2.41327
	Junior		151.7714	19.01715	3.21449
Registrars' perception of learning	Senior	0.017	33.7500	4.70174	0.67864
	Junior		36.4286	5.06014	0.85532
Registrars' perception of course organizers	Senior	0.260	33.3750	4.25578	0.61427
	Junior		34.6000	5.23675	0.88517
Registrars' academic self perception	Senior	0.287	22.7917	3.47611	0.50173
	Junior		23.6571	3.74121	0.63238
Registrars' perceptions of atmosphere	Senior	0.585	36.4792	4.87281	0.70333
	Junior		37.0857	5.04900	0.85344
Registrars' social self perceptions	Senior	0.303	18.9792	2.61330	0.37720
	Junior		19.6857	3.34990	0.56624

Table 4
ANOVA analysis – Year 3–6 Mean Overall and Subscale Scores.

		N	Mean	Std. deviation	Std. error	95% Confidence interval for mean		Minimum	Maximum
						Lower bound	Upper bound		
DREEM overall score	Year 3	21	152.7143	22.22418	4.84971	142.5980	162.8306	119.00	196.00
	Year 4	14	150.3571	13.50560	3.60952	142.5592	158.1550	134.00	173.00
	Year 5	29	145.8276	20.21504	3.75384	138.1382	153.5170	99.00	187.00
	Year 6	19	144.5789	9.65698	2.21546	139.9244	149.2335	124.00	164.00
	P value	**0.345**	148.0482	17.90006	1.96479	144.1396	151.9568	99.00	196.00
Registrars' perception of learning	Year 3	21	36.8571	5.34121	1.16555	34.4259	39.2884	29.00	48.00
	Year 4	14	35.7857	4.72601	1.26308	33.0570	38.5144	28.00	46.00
	Year 5	29	34.2759	5.05609	0.93889	32.3526	36.1991	24.00	47.00
	Year 6	19	32.9474	4.10249	0.94118	30.9700	34.9247	23.00	42.00
	P value	**0.069**	34.8795	5.00584	0.54946	33.7865	35.9726	23.00	48.00
Registrars' perception of course organizers	Year 3	21	33.9524	5.80927	1.26769	31.3080	36.5967	22.00	44.00
	Year 4	14	35.5714	4.25557	1.13735	33.1143	38.0285	26.00	43.00
	Year 5	29	33.7241	5.16096	0.95837	31.7610	35.6873	21.00	43.00
	Year 6	19	32.8421	2.31572	0.53126	31.7260	33.9582	27.00	36.00
	P value	**0.201**	33.8916	4.70343	0.51627	32.8645	34.9186	21.00	44.00
Registrars' academic self perception	Year 3	21	24.0952	3.94848	0.86163	22.2979	25.8926	18.00	32.00
	Year 4	14	23.0000	3.44182	0.91987	21.0127	24.9873	15.00	27.00
	Year 5	29	22.8621	3.66181	0.67998	21.4692	24.2549	13.00	30.00
	Year 6	19	22.6842	3.26688	0.74947	21.1096	24.2588	16.00	31.00
	P value	**0.584**	23.1566	3.59363	0.39445	22.3719	23.9413	13.00	32.00
Registrars' perceptions of atmosphere	Year 3	21	37.0000	5.51362	1.20317	34.4902	39.5098	28.00	46.00
	Year 4	14	37.2143	4.45798	1.19145	34.6403	39.7882	30.00	46.00
	Year 5	29	36.4828	5.94991	1.10487	34.2195	38.7460	17.00	47.00
	Year 6	19	36.4737	2.63246	0.60393	35.2049	37.7425	33.00	43.00
	P value	**0.939**	36.7349	4.92649	0.54075	35.6592	37.8107	17.00	47.00
Registrars' social self perceptions	Year 3	21	20.0952	3.49149	0.76190	18.5059	21.6845	15.00	27.00
	Year 4	14	19.0714	3.14922	0.84166	17.2531	20.8897	14.00	24.00
	Year 5	29	18.8966	2.82014	0.52369	17.8238	19.9693	12.00	27.00
	Year 6	19	19.1053	2.33083	0.53473	17.9818	20.2287	16.00	24.00
	P value	**0.533**	19.2771	2.94798	0.32358	18.6334	19.9208	12.00	27.00

Table 5
KCL vs. Greek Students DREEM mean scores.

	KCL vs. Greek medical school	P value	Mean	Std. deviation	Std. error mean
DREEM overall score	International	0.061	155.1905	20.36816	4.44470
	Greek		145.6290	16.46779	2.09141
Registrars' perception of learning	International	0.003	37.9048	5.04881	1.10174
	Greek		33.8548	4.59453	0.58351
Registrars' perception of course organizers	International	0.326	34.9048	5.69126	1.24194
	Greek		33.5484	4.31800	0.54839
Registrars' Academic Self Perception	International	0.151	24.1905	3.80288	0.82986
	Greek		22.8065	3.48222	0.44224
Registrars' perceptions of atmosphere	International	0.185	38.0000	4.98999	1.08891
	Greek		36.3065	4.87075	0.61859
Registrars' social self perceptions	International	0.055	20.4286	3.15549	0.68859
	Greek		18.8871	2.79405	0.35484

fairly novel combination of learning experience. High fidelity In Vivo Simulation Based Learning (SBL) is quite uncommon in the undergraduate level, and only a few studies have reported results from in vivo based SBL courses [35]. Besides that, ESMSC offers the

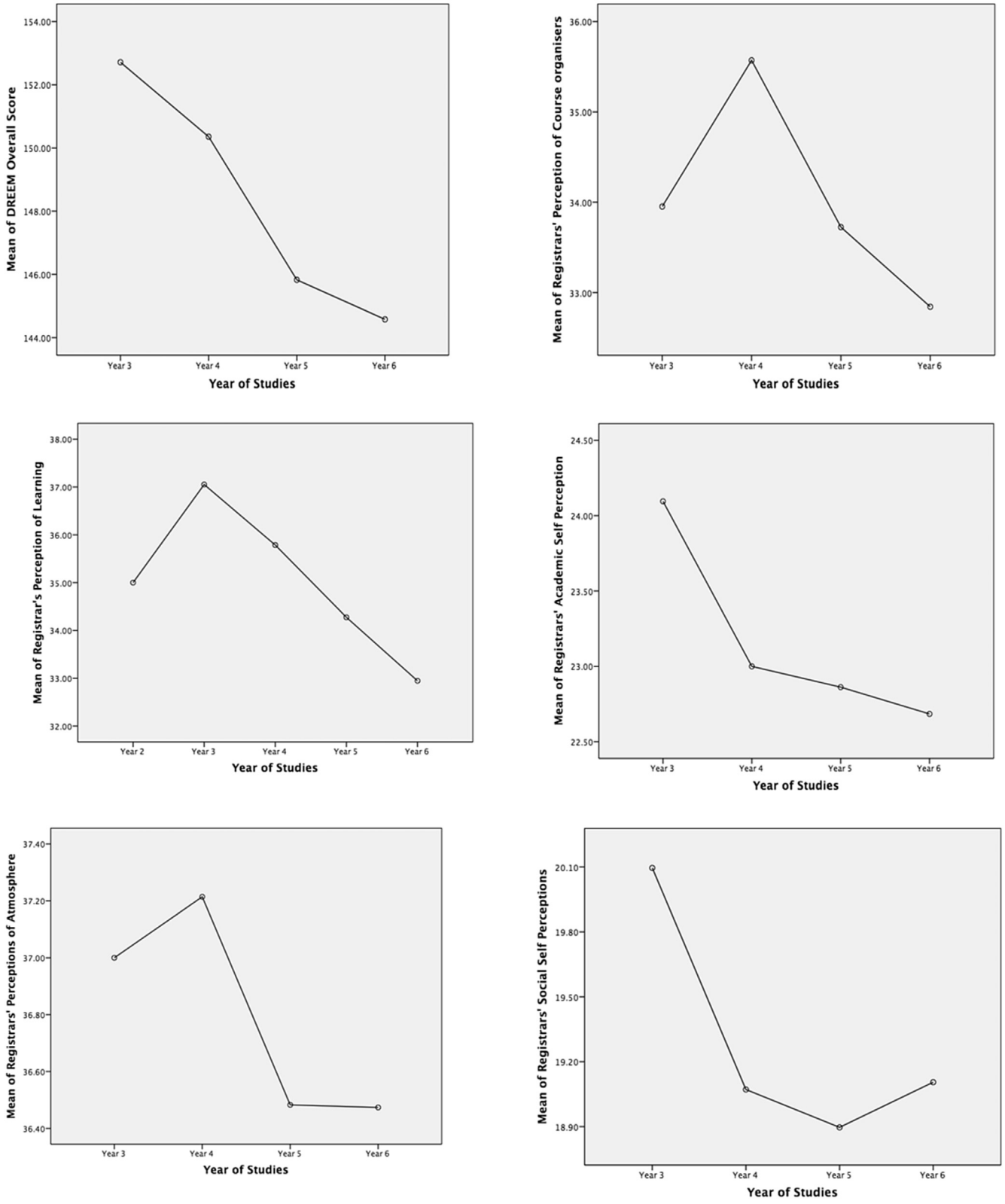
Table 6
ANOVA Analysis of mean scores across various Universities.

		N	Mean	Std. deviation	Std. error	95% Confidence interval for mean		Minimum	Maximum
						Lower bound	Upper bound		
DREEM overall score	KCL	21	155.1905	20.36816	4.44470	145.9190	164.4620	119.00	196.00
	Athens	15	147.4000	17.16641	4.43235	137.8936	156.9064	118.00	180.00
	Herakleion	5	116.8000	19.54994	8.74300	92.5255	141.0745	99.00	145.00
	Ioannina	3	148.0000	13.52775	7.81025	114.3952	181.6048	134.00	161.00
	Larisa	7	146.2857	13.11125	4.95559	134.1598	158.4116	133.00	172.00
	Patra	9	150.4444	11.53377	3.84459	141.5788	159.3101	132.00	173.00
	Thessaloniki	20	150.3000	12.79432	2.86090	144.3121	156.2879	134.00	187.00
	Alexandroupoli	3	135.3333	8.08290	4.66667	115.2543	155.4124	128.00	144.00
	P value	**0.002**	148.0482	17.90006	1.96479	144.1396	151.9568	99.00	196.00
Registrars' perception of learning	KCL	21	37.9048	5.04881	1.10174	35.6066	40.2030	31.00	48.00
	Athens	15	33.6000	5.75450	1.48581	30.4133	36.7867	23.00	42.00
	Herakleion	5	29.2000	3.42053	1.52971	24.9529	33.4471	26.00	35.00
	Ioannina	3	35.6667	4.72582	2.72845	23.9271	47.4062	32.00	41.00
	Larisa	7	33.8571	3.43650	1.29887	30.6789	37.0354	30.00	39.00
	Patra	9	34.4444	3.67801	1.22600	31.6173	37.2716	28.00	40.00
	Thessaloniki	20	34.9500	4.48946	1.00387	32.8489	37.0511	28.00	47.00
	Alexandroupoli	3	32.0000	2.64575	1.52753	25.4276	38.5724	29.00	34.00
	P value	**0.015**	34.8795	5.00584	0.54946	33.7865	35.9726	23.00	48.00
Registrars' perception of course organizers	KCL	21	34.9048	5.69126	1.24194	32.3141	37.4954	22.00	44.00
	Athens	15	33.2667	4.38287	1.13165	30.8395	35.6938	24.00	41.00
	Herakleion	5	27.4000	5.94138	2.65707	20.0228	34.7772	21.00	35.00
	Ioannina	3	35.3333	4.61880	2.66667	23.8596	46.8071	30.00	38.00
	Larisa	7	33.8571	4.77593	1.80513	29.4401	38.2741	29.00	43.00
	Patra	9	33.8889	3.14024	1.04675	31.4751	36.3027	30.00	40.00
	Thessaloniki	20	35.0000	3.38728	0.75742	33.4147	36.5853	26.00	43.00
	Alexandroupoli	3	32.0000	0.00000	0.00000	32.0000	32.0000	32.00	32.00
	P value	**0.073**	33.8916	4.70343	0.51627	32.8645	34.9186	21.00	44.00
Registrars' academic self perception	KCL	21	24.1905	3.80288	0.82986	22.4594	25.9215	18.00	32.00
	Athens	15	23.8000	3.89505	1.00570	21.6430	25.9570	16.00	31.00
	Herakleion	5	17.6000	3.43511	1.53623	13.3347	21.8653	13.00	21.00
	Ioannina	3	23.6667	2.08167	1.20185	18.4955	28.8378	22.00	26.00
	Larisa	7	23.5714	2.43975	0.92214	21.3150	25.8278	21.00	27.00
	Patra	9	23.7778	2.48886	0.82962	21.8647	25.6909	20.00	27.00
	Thessaloniki	20	23.2000	2.64774	0.59205	21.9608	24.4392	18.00	30.00
	Alexandroupoli	3	18.3333	3.51188	2.02759	9.6093	27.0573	15.00	22.00
	P value	**0.003**	23.1566	3.59363	0.39445	22.3719	23.9413	13.00	32.00
Registrars' perceptions of atmosphere	KCL	21	38.0000	4.98999	1.08891	35.7286	40.2714	28.00	46.00
	Athens	15	37.6667	4.79086	1.23700	35.0136	40.3198	29.00	46.00
	Herakleion	5	27.4000	6.22896	2.78568	19.6657	35.1343	17.00	33.00
	Ioannina	3	38.0000	3.60555	2.08167	29.0433	46.9567	34.00	41.00
	Larisa	7	34.0000	3.21455	1.21499	31.0270	36.9730	31.00	40.00
	Patra	9	37.2222	3.89801	1.29934	34.2260	40.2185	30.00	43.00
	Thessaloniki	20	37.7000	3.38884	0.75777	36.1140	39.2860	33.00	47.00
	Alexandroupoli	3	36.0000	3.60555	2.08167	27.0433	44.9567	32.00	39.00
	P value	**0.001**	36.7349	4.92649	0.54075	35.6592	37.8107	17.00	47.00
Registrars' social self perceptions	KCL	21	20.4286	3.15549	0.68859	18.9922	21.8649	15.00	27.00
	Athens	15	18.5333	2.82506	0.72943	16.9689	20.0978	14.00	24.00
	Herakleion	5	15.8000	3.03315	1.35647	12.0338	19.5662	12.00	20.00
	Ioannina	3	17.0000	2.00000	1.15470	12.0317	21.9683	15.00	19.00
	Larisa	7	20.0000	2.30940	0.87287	17.8642	22.1358	17.00	24.00
	Patra	9	20.7778	2.99073	0.99691	18.4789	23.0767	17.00	27.00
	Thessaloniki	20	19.0000	2.44949	0.54772	17.8536	20.1464	14.00	24.00
	Alexandroupoli	3	18.6667	0.57735	0.33333	17.2324	20.1009	18.00	19.00
	P value	0.019	19.2771	2.94798	0.32358	18.6334	19.9208	12.00	27.00

advantage of a mixture between British and Hellenic undergraduate students. This characteristic generates the opportunity to assess the views of trainees from different educational backgrounds on similar educational aspects and training methods. While relative homogeneity of the students is achieved through the online selection portal (esmsc.gr) [32], ESMSC invites delegates at the level of participation in medical school clinical rotations, which results in a good variety of Year 3–6 Students. Thus, ESMSC could serve as an opportunity to attempt to reach conclusions on different views of students from diverse educational and stage-of-studies background, on a novel educational experience.

Despite a formal feedback report being an indicator of students' perception on an educational experience, there remains concern regarding any subjectivity; hence any conclusions could enclose bias. Therefore, choosing a formally validated tool [8,9] could confirm our observations and import answers on our question of how do different students perceive the ESMSC learning experience. The DREEM inventory seems to be the most accurate tool [8] with multiple applications [10] in the undergraduate and postgraduate training [36,37]. It has been generally used to assess several medical schools' profile [34], or to compare following newly implemented changes, the educational environment of various undergraduate curricula following newly implemented changes [1,38,39]. There have been studies which use DREEM to compare different medical education institutions, students at different training stage, as well as different participant gender.

In our study, ESMSC is considered to be "a more positive than negative" educational environment, with the mean overall score (148.05 ± 17.90), and compared to other reported scores in the literature [6,7,40–44], it seems to be an encouraging finding that complements the students' excellent feedback report [32]. Moreover, subscale scores appear to confirm the overall good impression of participants, as reflected by "A more positive Perception of learning" (34.88, ±5.01), "Moving in the right direction" (33.89,



Graph 2. Comparison of the mean Scores of DREEM inventory based on Year of Studies.

4.70), "Feeling on the Positive Side" (23.15, ±3.59) etc. This confirms our primary hypothesis, that the students perceive ESMSC as a valuable educational experience, and objectively improve their performance in various skills [32]. Another interesting finding is that, the vast majority of mean scores, including overall, are fairly close (0,11–2.96) towards the highest class, and this generates some more interest towards achieving excellence in SBL teaching.

While SBL is widely used in the higher postgraduate training [45–47], it is becoming all the more an integrated feature of various undergraduate curricula [35,48,49]. Our study confirms that students perceive positively this high fidelity SBL experience. There has been a discussion about integration of basic surgical skills (BSS) training as part of the undergraduate curriculum{Hamaoui, 2013 #146}, and this seems to be underlined by our delegates' perceptions on ESMSC course. As various Medical Schools are considering updating their curricula, this could be a hint that may to be taken into consideration, whilst setting up a novel strategy for the undergraduate education.

Comparing Year 3/4 vs. Year 5/6 Students, it seems that junior students l perceive the same learning experience in an overall more positive manner (Overall-151.77 vs. 145.33, $p = 0.114$, RPoL-36.42 vs. 33.75, $p = 0.017$), despite (or BECAUSE of) ESMSC involving more advanced In Vivo modules. Interestingly, ANOVA analysis shows that DREEM overall and sub-scale scores tend to decline as students are moving from Year 3 to the Final Year (Graph 2), although this did not reach statistical significance ($p > 0.05$, Table 4). Demlroren et al. [50] reports similar patterns, where Year 3 students have the highest scores (Year 3 vs. Year 5, 123.65 vs.109.39). Al-Ayen et al. [51] also notes as well that Year 1 students tend to have the most positive scores compared to clinical year students. This is an interesting finding indicating that while students progress through their undergraduate studies, they potentially become less optimistic, and this should raise a question, whether more support is needed within the framework of the undergraduate curriculum in terms of continuous positive reinforcement and in particular towards graduation.

Junior students seem to be more enthusiastic, and despite the in vivo dissections' modules being more advanced, which could potentially raise difficulties in their learning process, they still seem to enjoy the course more. Furthermore, in our previous study [32], we demonstrated that junior students perform similarly in the objective assessments. Therefore, we should approach these findings with a more holistic view, and question whether more hands-on skills training is required at an earlier stage to promote learning, as well as motivate students towards a more positive attitude towards their learning process.

With regards to the comparison between KCL vs. Greek Students, UK students tend to perceive most of the aspects of the course in a more positive manner ("Excellent" vs. "more positive than negative, 155.19 vs. 145.62, $p = 0.061$). RPoL is perceived by UK students as "Teaching highly though of" vs. "A more positive perception" (37.9 vs. 33.85, $p = 0.003$). Those findings could either be explained by the fact that KCL students were overall more junior (Year 3, $N = 15$, 75.4%, Year 4, $N = 2$, 9.5%, Year 5 $N = 4$, 19.1%), or by the fact that SBL modules are a well-integrated part of UK MBBS courses, hence students are more familiar with its concepts, whilst in Greece this is evolving in the last few years. In addition to that, ESMSC is an intense course, which completely runs in English. Therefore, this may contribute to further distress for the Hellenic Students, whose undergraduate curriculum is taught in Greek. In a study examining undergraduate curriculum reforms, Finn et al. [24] noted that non-Irish students who did not speak English as their first language, had a more negative perception of the same education environment compared to Irish students.

ANOVA analysis concludes that KCL students have the most positive perception of the ESMSC learning environment ($p = 0.002$, Table 6), while there is a variation noted between the Greek Institutions. For instance, students from the Athens or Thessaloniki Medical School, which are the biggest, demonstrate a more positive view of the ESMSC learning environment, compared to ones from smaller Universities i.e. Alexandroupoli or Herakleion (147.4, 150.30 vs. 135.33, 116.8 respectively, $p = 0.002$). Despite the sample being pretty small to allow conclusions, it seems that the bigger Universities in Greece, may offer some more support to their students and hence, promote motivation in learning, as well as a more positive view for an SBL educational environment. However, there have been some interesting studies published, that students' perception is similar, despite different ranking of Universities [42,52,53].

On the other hand, comparing male vs. female perceptions of the ESMSC educational environment, despite a slightly statistically non-significant higher, overall score of male students (149.2 vs. 145.2, $p = 0.434$), there does not seem to be any difference in the gender sub-scale perception scores. Similar findings are reported by other DREEM studies [14,51] in the literature.

Overall, despite the limitations of our sample, which comes from two consecutive cohorts of ESMSC course, our conclusions generate some interesting areas for future research. Firstly, as uniform standards for surgical training are implemented across Europe and the US, it would be interesting to compare students' view from more Countries and see if the overall perception on SBL training remains the same. Also, there still remains the question regarding what is the optimal stage for students to be involved in skills-based training, and how SBL can motivate students towards a surgical career. These points seem to be crucial, whilst Medical Schools' Boards seek for the optimal strategy to reform and modernize their curricula.

6. Conclusions

Medical Students seem to perceive the ESMSC educational environment in a positive way. Junior students tend to have a more positive view on the same learning experience compared to final year students, which should raise a question whether more SBL surgical teaching should be provided at an earlier stage, to promote motivation and learning. UK students seem to be more positively inclined towards on this novel learning environment. No significant difference was reported between male and female students' views on this course environment. These points should be taken into consideration, whilst various Medical Schools are reforming their new undergraduate training curricula.

Ethical approval

European and National Legislation, Directive 63/2010, PD 56/ April 2013.

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Author contribution

Main Contribution.

Michail Ch. Sideris and Apostolos E. Papalois: Equal Contribution, Lead of the Project, and Designers of the course curriculum, Main Editors of the Manual. MS drafted and edited manuscript

Statistical Analysis by MS.

Georgios Tsoulfas: Faculty of the Course, Lead for the In vivo Dissections (Anatomy Demonstration of the Abdomen), Conception and senior author of the Study.

Thanos Athanasiou, International lecturer during the course, edit of the manuscript, statistical analysis feedback.

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Georgios Zografos: Senior Advisor of the Course Curriculum and Manual, Lead of the Scientific Committee of the Course.

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Conflicts of interest

No conflict of interest.

Guarantor

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Manual of the course

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