

Attitudes towards Science and Alternative Medicine of Medical, Economics and Business, and Electrical Engineering Students in Split, Croatia

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Aim. To assess attitudes of students at the Split University Schools of Medicine, Economics and Business, and Electrical Engineering towards science and alternative medicine.

Methods. There were 275 respondents surveyed for their opinion on science and different aspects of alternative medicine. The respondents were grouped into three major groups: medical students (83 or 30%), economics and business students (95 or 35%), and electrical engineering students (97 or 35%). Each group was composed of two subgroups: first and final year students. We used a specially designed questionnaire composed of four parts to collect students' demographic data and investigate their scientific experience and attitudes towards science and alternative medicine. ANOVA was used to test the differences among the three major groups of students and between first and final year students within each group.

Results. There was no significant difference among the first year students at three different schools in their scores on attitude towards science (ANOVA; $F = 0.001$, $p = 0.99$) and the attitude towards alternative medicine ($F = 2.61$, $p = 0.08$). However, there was a significant difference among the final year students at the three schools, with medical students being the most positive in their score on the attitude towards science ($F = 7.30$, $p = 0.001$) and least positive in their score on the attitude towards alternative medicine ($F = 30.7$, $p < 0.001$). There was a negative correlation between attitudes towards science and alternative medicine ($r = -0.37$, $p < 0.001$) for all schools.

Conclusion. Medical students showed the most positive attitude towards science and least positive attitude towards alternative medicine, compared with the students of economics and business or electrical engineering. The curriculum of the Medical School, unlike the curricula of other two schools, could have an impact on students' attitudes towards science.

Key words: *attitude; complementary therapies; Croatia; science; students; students, medical*

Modern science is challenged by the growing number of various complementary and alternative approaches to solving health problems. Such approaches do not follow a strict scientific procedure, but exert certain influences at modern education provided on conventional universities. However, it is still unknown how it affects attitude of students toward science and scientific methods. Furthermore, different scientific fields, such as humanities, technical, and biological (natural) sciences, may be differently affected by these alternative approaches.

Medicine, as a very dynamic scientific area, is very sensitive to the influences of complementary or alternative medicine. Some patients show their dissatisfaction with physicians or conventional medicine in general, because they may see it as too complex and technologically oriented, impersonal, costly, inconvenient, unavailable, or inaccessible (1). Whereas

physicians usually want to alter the course of pathological processes, patients simply want to feel better (2), which leads to increased use of complementary or alternative medicine as defined by the Cochrane Collaboration (3). Alternative medicine lacks funding, research, academic infrastructure, sufficient patient number, undertaking and interpreting systematic reviews, and methodology (3). Although methods of alternative medicine have no scientific backup, this fact does not prevent 34% of adults in USA to use at least one unconventional form of health care (4). Patient decision to use complementary or alternative medicine is probably not based on evidence of its efficiency, but rather on belief that it can improve general well being or health as a complement to conventional treatment (5). Annual out-of-pocket costs of complementary or alternative medicine are US\$ 21.2-32.7 billion vs medical treatment costs of US\$ 29.3 billion (6).

There is an increasing trend towards alternative medicine among general US population (7). Also, more than 70-90% of the US physicians consider complementary or alternative medicine therapies, such as hypnotherapy or herbal therapy, to be legitimate medical practices. These physicians show high interest (8) and an open attitude (9) towards alternative therapies. Young physicians seem to judge complementary or alternative medicine more optimistically than their older colleagues (10). On the other hand, the study carried out in Slovenia showed strongly negative attitude of physicians to any form of complementary or alternative medicine (11).

Most medical students in the USA (84%) hold that having knowledge about complementary or alternative medicine will be important in their future career, and 2/3 of USA medical schools are including courses in complementary or alternative medicine into their curriculum (12).

Although the scientific basis is what predominantly differentiates complementary or alternative medicine from conventional medicine, courses teaching the basics of scientific research are not often included in medical schools curricula (13,14).

The study carried out at the Zagreb University School of Medicine showed that the first-year medical students are not familiar with basic facts about scientific methods and communication in medicine, although they have a positive attitude towards scientific research (15). We assumed that the difference between scientific and non-scientific approach would be more obvious in medicine than in other fields of science.

In this study, we compared the attitudes towards science and alternative medicine of students from Medical, Economics and Business, or Electrical Engineering Schools. We also tested whether the first- and the final-year students differed in their attitudes towards science and alternative medicine, which could

serve as a measure of impact of different education on science in different schools.

Subjects and Method

Subjects

We surveyed attitude towards science and alternative medicine of students at three Split University schools: School of Medicine, School of Economics and Business, and School of Electrical Engineering (275 respondents, Table 1) in the 2001/2002 academic year. Each of the three major groups of students was divided into two subgroups: the first- and final-year students. At the School of Medicine, the respondents were 83 students: 43 first-year and 40 final-year students. At the School of Economics and Business, 95 students participated in the study (50 first- and 45 final-year students). The total number of respondents at the School of Electrical Engineering was 97 (47 first- and 50 final-year students) (Table 1).

A special questionnaire was used to collect data during a randomly selected lecture class. Students attending the lecture were asked to fill out the questionnaire. The response rate was 100%. The same procedure was applied at all schools.

There was a total number of 47 first- and 43 final-year (sixth year) students at the Split University School of Medicine. The School of Economics and Business and the School of Electrical Engineering had greater population of first-year students (338 and

Table 1. Demographic characteristics of the students at three Split University Schools included in the study

School	Year	No. of students		Age* (years, median, range)
		total	sex	
Economics and Business	first	50	8 men, 42 women	19 (18-20)
	final	45	11 men, 34 women	23 (21-26)
	total	95	19 men, 76 women	19 (18-26)
Electrical Engineering	first	47	35 men, 12 women	19 (18-19)
	final	50	43 men, 7 women	22 (21-28)
	total	97	78 men, 19 women	21 (18-28)
Medicine	first	43	21 men, 22 women	19 (18-22)
	final	40	19 men, 21 women	25 (23-29)
	total	83	40 men, 43 women	22 (18-29)

*Kolmogorov-Smirnov test showed asymmetric data distribution. Data, shown as median values, were analyzed with Kruskal-Wallis test, which showed that medical student group was not older than the other two student groups ($p=0.08$).

Table 2. Students' attitudes towards science and alternative medicine and three Schools of the Split University

School	Curriculum year	No. of students	Attitude towards							
			science*			alternative medicine [†]				
			total score (mean ± SD)	F	p	total score (mean ± SD)	F	p		
Economics and Business	first	50	70.2 ± 8.0	0.12	0.731 [‡]	43.6 ± 5.4	0.2	0.655 [‡]		
	final	45	69.6 ± 7.7			44.0 ± 5.1				
	total	95	69.9 ± 7.8			43.8 ± 5.2				
Electrical Engineering	first	47	70.2 ± 8.7	0.01	0.946	43.2 ± 5.6	0.02	0.901 [‡]		
	final	50	70.3 ± 12.4			43.1 ± 6.5				
	total	97	70.3 ± 10.7			43.1 ± 6.1				
Medicine	first	43	70.1 ± 6.9	15.45	<0.001 [‡]	41.2 ± 4.7	30.49	<0.001 [‡]		
	final	40	77.4 ± 9.7			35.1 ± 5.5				
	total	83	73.6 ± 9.1			38.3 ± 5.9				
Total	first	140	70.2 ± 7.9	0.001	0.99 [§]	42.7 ± 5.3	2.61	0.08 [§]		
	final	135	72.2 ± 10.7			41.0 ± 6.9			30.7	<0.001 [§]
	total	275	71.2 ± 9.4			41.9 ± 6.2				

*Smaller score indicates less positive attitude towards science (minimum = 20, maximum = 100).

[†]Smaller score indicates less positive attitude towards alternative medicine (minimum = 13, maximum = 65).

[‡]F-value from ANOVA; p-value indicates differences between the first- and final-year students at the same school in their attitude towards science or alternative medicine.

[§]F-value from ANOVA; p-value indicates differences among the first- and final-year students at the three schools in their attitude toward science or alternative medicine.

^{||}F-value from ANOVA; p-value indicates differences among the students at different school in their attitude towards science or alternative medicine. Tukey HSD test for post-hoc analysis showed that medical students had more positive score than the Economics and Business ($p=0.02$) and Electrical Engineering students on attitude towards science scale ($p=0.04$). There was no significant difference between students of Economics and Business and Electrical Engineering ($p=0.97$). Post-hoc analysis with Tukey HSD test showed that the students of the Medical School had less positive score than the students of Economics and Business ($p<0.001$) and Electrical Engineering on their attitude towards alternative medicine scale ($p<0.001$).

485, respectively), but due to a large number of dropouts, their number was significantly smaller at the final, fourth, year (142 and 106, respectively). Students of both Economics and Business and Electrical Engineering School were more heterogeneous group than medical students and did not attend lecture classes in large numbers like medical students. As we decided to survey only those who attended lectures, eventually all groups were of similar size, 40 to 50 students per group.

Questionnaire

The questionnaire consisted of four parts: (A) demographics (5 items), (B) general questions about students' scientific experience (3 items), (C) attitude towards alternative medicine (13 items) and usage of and opinion on specific alternative medicine disciplines (24 items), and (D) attitude towards science (20 items).

The C section of the questionnaire (alternative medicine section) consisted of 13 statements that measured the respondents' attitude towards alternative medicine (Likert-type, 5-point rating scale: 1 – strongly disagree, 2 – disagree, 3 – no opinion, 4 – agree, 5 – strongly agree). There were 6 negative and 7 positive statements. We summarized 13 answers on a 5-point rating scale and computed the total score for each individual (minimum value of 13 and maximum value of 65). The average value for each subgroup of students was analyzed (Table 2). The D section consisted of 20 (10 negative and 10 positive) statements that measured the respondents' attitude towards science. This scale was also a Likert-type, 5-point rating scale. We performed the same procedure for alternative medicine scale to determine individual and total scores for attitude towards science (minimum value of 20 and maximum value of 100).

Cronbach α for both science and alternative medicine sections was 0.61. The reliability of alternative medicine and science subscales was 0.66 and 0.82, respectively.

Statistical Analysis

We used Statistica 6.0 software package for Windows to perform statistical analysis of data. Kolmogorov-Smirnov test was used to test the normal distribution of the age data and Kruskal-Wallis test was used to test the differences in age among the tested groups. ANOVA with Tukey HSD post-hoc test was used to estimate differences between variances of students' opinions on science and alternative medicine. Pearson chi-square test was used to test the differences among the three schools in students' positive opinion on different alternative medicine disciplines. We computed the correlation matrix, using Pearson's product-moment correlation for analysis of correlations among students' attitudes towards science and towards alternative medicine. All statistical values were considered significant at the α -level of 0.05.

Results

A similar number of students was surveyed at each school. Out of 83 respondents at the Medical School, 40 were men and 43 women. There were significantly more women ($n=76$) than men ($n=19$) in the surveyed group at the School of Economics and Business, whereas at the School of Electrical Engineering, there were 78 men and 19 women in the respondent group (Table 1).

However, there was no difference between men and women in their attitude towards science scores (score [mean \pm SD], 71.7 \pm 10.7 for men and 70.6 \pm 7.9 for women, on a scale from 20 to 100; $F=0.783$, $p=0.377$) or attitude towards alternative medicine scores (41.6 \pm 6.4 for men and 42.2 \pm 6.0 for women, on a scale from 13 to 65; $F=0.974$, $p=0.324$). Although medical curriculum is two years longer than curricula of other two schools, there was no significant difference in the age of respondents (Kruskal-Wallis, $p=0.08$, Table 1).

Attitude towards Science

There was no significant difference among the first-year students at three different schools in their scores on attitude towards science scale (ANOVA; $F=0.001$, $p=0.99$; Table 2). However, there was a significant difference among the final year students at the three schools in their scores on attitude towards science scale, with medical school students having the most positive attitude ($F=7.30$, $p=0.001$; Table 2).

There was a significant difference in the attitude towards science among students from different schools ($F=4.18$, $p=0.016$), irrespective of the year of studies. Respondents at the School of Medicine achieved significantly higher total score (73.6 \pm 9.1) than students of Economics and Business (69.9 \pm 7.8, Tukey HSD *post-hoc* test, $p=0.02$) or students of Electrical Engineering (70.3 \pm 10.7, Tukey HSD *post-hoc* test, $p=0.04$). There was no significant difference between students of School of Economics and School of Electrical Engineering (Tukey HSD *post-hoc* test, $p=0.97$).

Analysis of the respondents at the Medical School showed that the final-year students had higher scores than the first-year students (77.4 \pm 9.7 vs 70.1 \pm 6.9; $F=15.45$, $p<0.001$). There was no significant difference between the first- and final-year students at the School of Economics and Business (70.2 \pm 8.0 vs 69.6 \pm 7.7; $F=0.12$, $p=0.731$) or at the School of Electrical Engineering (70.2 \pm 8.7 vs 70.3 \pm 12.4; $F=0.01$, $p=0.946$).

Attitude towards Alternative Medicine

There was no significant difference among the first-year students at the three schools in their score on attitude towards alternative medicine scale (ANOVA; $F=2.61$, $p=0.08$; Table 2). However, there was a significant difference among the final year students at the three schools in their scores on attitude towards alternative medicine scale, with medical school students having the least positive attitude ($F=30.7$, $p<0.001$; Table 2).

Medical students had the lowest score on this scale (38.3 \pm 5.9), compared with the students of Economics and Business (43.8 \pm 5.2) and Electrical Engineering (43.1 \pm 6.1) (ANOVA; $F=24.15$, $p<0.001$; Table 2).

The first-year medical students had significantly higher total scores than the final-year medical students (41.2 \pm 4.7 vs 35.1 \pm 5.5; $F=40.49$, $p<0.001$). Analysis of variance revealed no significant difference between the first- and final-year students at the School of Economics and Business (43.6 \pm 5.4 vs 44.0 \pm 5.1; $F=0.2$, $p=0.655$) or School of Electrical Engineering (43.2 \pm 5.6 vs 43.1 \pm 6.5; $F=0.02$, $p=0.901$).

More than 80% of respondents (Fig. 1) thought that herbal therapy had positive effects on human physical and psychological health, whereas only about 35% thought the same for radiesthesia. Medical students showed least positive opinion on positive effects of any alternative discipline on human physical and/or psychological health than students from

the other two schools (Pearson chi-square, $p < 0.05$), except for the positive effects of hypnosis, where all three groups had similar responses ($p = 0.938$).

Correlation analysis showed negative association ($r = -0.37$, $p < 0.001$) between the total scores on the two attitude scales for all respondents. The values for individual groups were as follows: 83 medical students, $r = -0.5$, $p < 0.001$; 97 electrical engineering students, $r = -0.28$, $p = 0.005$; and 95 economy and business students, $r = -0.25$, $p = 0.016$.

Discussion

The results of our study showed that the students of Economics and Business School and students of Electrical Engineering (a technical school) had significantly less positive attitude towards science than medical students. There was no significant difference between the students of Economics and Business and Electrical Engineering. Although the results on science scale for the first-year students were similar for all three schools, the difference was observed for the final-year students. Also, medical students had less positive attitude towards alternative medicine than other two groups of students.

Health effects of different disciplines of alternative medicine were also judged less positively by the medical students than by their colleagues from other two schools at the Split University.

Another important finding was that final-year medical students showed significantly more positive attitude towards science and significantly more negative attitude towards alternative medicine than their first-year peers, whereas no such trend was observed at other two schools.

One of the limitations of this study was a selection of students for the survey. The sample was not randomized, but we surveyed 40 to 50 students per group. The three schools differ in student number, so

there was the largest portion of medical students (86 and 87%, for the first and the final year, respectively) surveyed, and much smaller portion of students at Economics and Business (15 and 32%) and Electrical Engineering (10 and 47%) Schools. The study included all students attending lectures. At the Medical School all lectures are obligatory, unlike the lectures at other two schools. We assumed that if there was a difference among the students at Economics and Business and Electrical Engineering schools, with highly motivated ones attending non-mandatory lectures more frequently, we would reach those who were more like medical students in respect of amount of studying/attending classes and presumably represented the more successful portion of the student population. Therefore, we can assume that, if we surveyed the whole student population, results for these two schools would have been even less positive.

There is a possibility that the difference in the negative attitude towards alternative medicine between the first- and final-year medical students is a result of rigid, conservative, or traditional medical education at the School, which ignores complementary or alternative medicine methods in the treatment of patients. However, medical students showed increase in their positive attitude towards science from the first to the final year as well, whereas no such changes in attitude towards either alternative or science medicine were observed in other two schools.

The important fact is that Medical School curriculum lasts six years and the curricula of other two schools only four. Therefore, final-year medical students might have been older than their colleagues at other two schools. However, there was no significant difference in their age. Although age may play an important role in developing a more positive attitude towards science, we believe that the additional two years of education were more important than age *per se*. Preliminary data of another study currently going

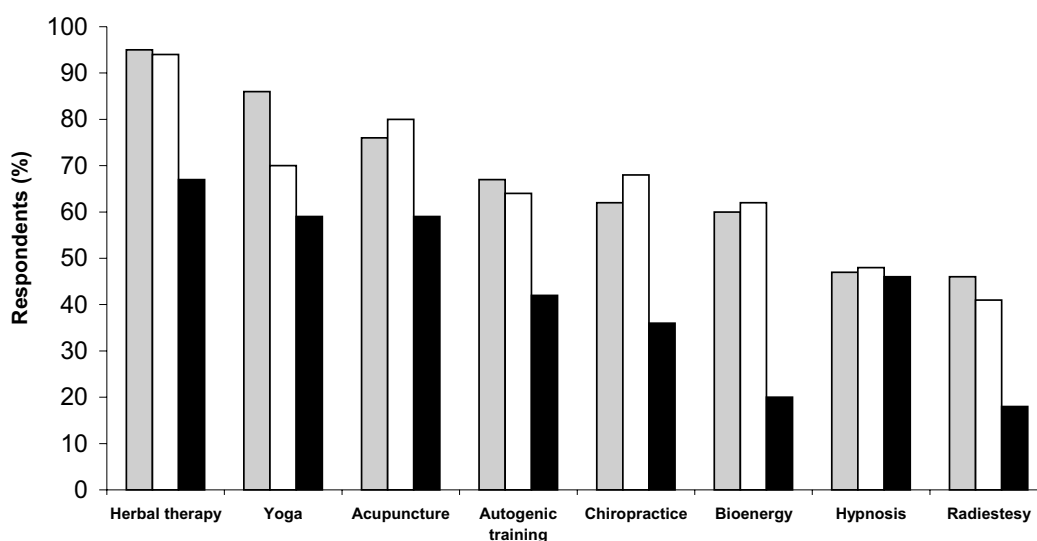


Figure 1. Proportion of surveyed students of the School of Economics and Business (gray bars), School of Electrical Engineering (open bars), and Medical School (closed bars) who think that different disciplines of alternative medicine have positive effects on human physical and/or psychological health.

on indicates that there is no positive correlation between age and attitudes towards either science or alternative medicine in the group of nurses, who compose the population heterogeneous in age and homogeneous in the level of education.

The study from the National University of Mexico also found a positive shift in the attitude of medical students at the final year of studies (16).

It would be interesting to test how different teaching methods at different schools, in different branches of science, contribute to the development of attitude towards scientific theories and methods, as well as other attitudes related to science. Until a student is familiar with the principles of scientific methods, it is hard to expect from him or her to distinguish science from alternative or parascientific approach.

In 1997, we introduced a new course "Principles of Scientific Research in Medicine" into the second-year curriculum at Medical School in Split (17), which is closely related to the courses of Informatics and Statistics. This may explain the more positive attitude of final-year medical students towards science.

There were significant differences among student groups in their opinions on different alternative medicine disciplines. Students' attitude towards specific alternative disciplines showed they had the most positive opinion on herbal therapy and least positive opinion on radiesthesia. Another study from Croatia showed that students' sex, place of origin, and type of high school, ie, type of pre-university education, did not influence their positive attitude towards science (15). The only factor related to the positive attitude towards science was the rank on the medical school admission test (15).

In conclusion, our results showed that medical students had the most positive attitude towards science, compared with the students of other two schools and the least favorable opinion on positive effects of all alternative medicine disciplines, but hypnosis. The results of this study also suggest that the curriculum at the Split Medical School, but not at the Schools of Economics and Business and Electrical Engineering, may have an impact on the students' attitudes towards science and alternative medicine.

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