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Artūrs Utināns

CHANGE OF RATIO
OF MAGICAL THINKING,
PARANORMAL BELIEFS AND
CRITICAL THINKING DISPOSITION
IN MEDICAL STUDY PROCESS

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ABBREVIATIONS USED

CT	– critical thinking
CTD	– critical thinking disposition
CTDAS	– critical thinking disposition assessment scale
CTDES	– Critical thinking dispositon extra scale
MT	– magical thinking
MIS	– Magical ideation scale
RPBS	– Revised paranormal belief scale
PE	– paranormal experiences
RSU	– Rīga Stradiņš University
PB	– paranormal beliefs
TRB	– Traditional religious beliefs

INTRODUCTION

Surveys and studies show, that magical thinking and belief in the paranormal phenomena are still dominant in all students' groups. It can be encountered also among Rīga Stradiņš University students. By the concept "magical", "paranormal" are understood the phenomena which are immaterial and are opposite to the contemporary scientific understanding, such as belief in telling the future, belief in ghosts or the ability to communicate with the dead, belief in telepathy, telekinesis, belief in magic, belief in reincarnation, belief in evil or good fate.

On the other hand, disposition to think critically is defined as a constant internal motivation to solve problems and to make decisions, using critical thinking [Facione, 2000]. The most commonly mentioned critical thinking disposition features include [Lai, 2011]: (1) openness of mind, which denotes the readiness to change one's point of view in the name of a statement of the truth, and which there is an opposite feature to dogmatism, (2) honesty, thinking without prejudices, (3) wish to look for true causes or truth-seeking; (4) inquisitiveness, a wish to be well informed; (7) readiness to consider other views. It is important to investigate, how different types of thinking are exposed, preserved, how they change and interact in the students' minds.

1. TOPICALITY OF STUDY

The theme of the doctoral work is topical, taking into account four aspects:

1. Pedagogical aspect – quality of scientific education of specialists and the influence of the acquired information on students;
2. Psychodynamic and cognitive aspects – reciprocally opposite views, like the belief in the paranormal and magic, and critically-scientific thinking, existence and dynamics in students' minds;
3. Aspect of students' mental health;
4. Philosophical aspect – topicality of medical students', like future specialists, world outlook in its widest sense.

One of the RSU strategic aims is to train highly qualified specialists in health care and other fields for the work in Latvia and the European Union.

It is important that during the study time the acquired knowledge, skills and competences would correspond to the requirements adopted in the European single higher educational area.

We know from human psychodynamic studies, that in the majority of people, if not in all, one can encounter the magical thinking (MT) and paranormal beliefs (PB). According to contemporary scientific postulates it is contrary both to the real contact with the reality, and to the evidence-based critical thinking, which is being developed in medical and health care studies. It is important to find out the students' magical and critical thinking level and the dynamics of these different thinking types in a relatively long study process.

Both a student's, as well as any person's mental health, according to many scientists, is the contact with the reality and freedom from illusion captivity. Especially acute it is, when referring to the medical profession, which plays a significant role in the education of other people on health promotion.

The reasons for the investigation of magical thinking and belief in the paranormal, according to many scientists, are their markedly undesirable mental and social consequences. Belief in the paranormal predisposes the people to interpret normal events like paranormal ones, it causes false and unrealistic expectations, and it affects one's abilities to think critically and scientifically [Genovese, 2005; Irwin, 2009]. Obsession with PB can make a man antagonistic to science and critical thinking [Genovese, 2005]. Belief is formed, that objectiveness is illusion and one can trust the intuition like the best type of problem solution [Irwin, 2009]. Those who believe in the paranormal are deceived by charlatans, who offer clairvoyance seances or alternative therapies, thus causing financial losses. Magical thinking can strengthen the dependence on gaming machines, by maintaining illusory ability to control the gaming machine action in favour of oneself [Genovese, 2005; Irwin, 2009]. The health of those who believe in the paranormal can be damaged due to anxiety and a sense of guilt. MT promotes affection to vegetarianism and veganism, which can reduce the necessary nutrients for the body [Irwin, 2009]. PB and MT can activate modern health worries in relation to the new technical advancements [Petrie & Wessely, 2002; Saher et al., 2006; Utināns, Ancāne, 2014]. Believers in the paranormal can withdraw from constructive activities to solve social and economic problems of their environment. Obsession with PB can become so pronounced, that people become destructively dependant on the paranormal [Irwin 2009]. People with PB may become stigmatized, because they believe in the absurd [Irwin, 2009]. If believers in the paranormal join the destructive sect, they may be morally and mentally oppressed in this sect [Irwin, 2009]. Believers in the paranormal who want to do parapsychological studies can feel the pressure to succeed and become inattentive or even falsify the data, paying for it their professional or moral price [Irwin, 2009]. MT creates an illusion that uncommonly a complicated problem solution can be achieved just for nothing, without any hard work. In such a way an inability

develops in carrying out well-informed decisions [Genovese, 2005]. The current research study adds a thesis, that medical students, residents and doctors can disseminate or strengthen magical thinking and paranormal views between patients, which not always will turn out to be good for the latter.

Critical thinking in the medical study process is necessary in order to understand physiology along with its materialistic regularities [Abraham et al., 2004]; KT is the component of the evidence-based medicine [Pitkala et al., 2000; Sacher-Mendiola et al., 2012]; KT is significant for the reduction of diagnostic errors [Harasym et al., 2008]; KT is necessary for the assessment of a large amount of the information in the study process and in the choice between alternative hypotheses and the assessment of the acquired knowledge [Azer, 2008; D'Antoni et al., 2010]; KT increases students' responsibility and the ability to check the heard hypothesis [Maudsley, Strivens, 2000; Carvour, 2013]; KT helps medical students become self-directed learners [West et al., 2000]; KT distinguishes valid and invalid scientific theories [Morier, Keeports, 1994]. There is an opinion, that scientific education carriers should include the criticism of paranormal phenomena as an essential part of scientific education from the very start of studies [Martin, 1994; Morier, Keeports, 1994; Fishman, 2009].

2. PLAN OF STUDY

2.1. Study aim

The aim of the study was to find out the proportion of disposition of MT, TP (belief in the paranormal) and KTD of the students of medical study programme, comparing the changes of these factors during the study process, as well as the associations of these interrelated factors within the study process.

2.2. Study objectives

To implement the study aim, the following study tasks were put forward:

1. To determine MT, PB, TRB and proportion of pseudoscientific beliefs among respondents of medical study programme.
2. To determine a proportion of CTD among respondents of medical study programme.
3. To compare MT, PB, belief in pseudoscientific views and CTD differences of mean values of responses of students by study years.
4. To check PB and CTD interrelated associations of mean values of responses of respondents of medical study programme.
5. To compare mean values of responses of medical study programme respondents with mean values of responses of respondents of health care and social sciences study programme.
6. To evaluate other RSU students-related factors: gender, distress, chronic illnesses, loneliness, spontaneous abnormal experience, TRB and confessional-related associations with belief in the paranormal or CTD.

2.3. Study hypothesis

The following hypotheses were put forward:

1. Among RSU medical study programme students, despite the study of natural sciences and materialistic study content, one can encounter magical thinking, paranormal beliefs and pseudo-scientific beliefs.
2. Magical thinking and belief in the paranormal are negatively associated with the critical thinking disposition. MT, PB and the proportion of pseudoscientific beliefs by medical study years is reducing, while the proportion of critical thinking disposition students is increasing. The more expressed is CTD, the less expressed is MT, PB and pseudoscientific beliefs. At the same time traditional religious beliefs does not change by years. The alternative hypothesis – MT, PB and CTD are functioning in parallel one to another.

2.4. Scientific novelty of study

Determination of interrelated associations of the magical thinking, paranormal beliefs and critical thinking disposition in one of Latvian universities was carried out for the first time. The study reveals the effectivity of teaching scientific thinking, turning attention to students' internal motivation to be scientifically educated and knowledgeable, and having a wish to explore the truth, changing their views under the influence of new facts. A new Critical thinking disposition extra scale was made in the study, where students could choose in the statements, what information sources to use, and to pay attention to the ability to give up theories, if they are not approved by facts. The study results show, how many students accept the opinion of different scientific authorities, and how ready they are to prefer the facts, if they are contradicting

to the statements of the authorities. The data allow us to conclude, to what extent the students are ready to accept the reality of the facts, or want to live in illusions offered by some public authorities. According to the latests neuroscientific theories, in the present doctoral work there was studied the possibility, that MT, PB, including superstitions and belief in the magic, exist in students' minds in parallel to scientific and critical thinking. Such a coexistence depicts the mutual competition of evolutionally oldest intuitive thinking system and evolutionary newest rational thinking system.

3. METHODOLOGY OF STUDY

Structure of the study over the time – a cross-sectional study. It is a descriptive prevalence study, non-experimental and based on students' poll.

For the study needs there was developed an electronic questionnaire, consisting of four separate questionnaires (three international and one, developed by the study author), in total – 120 questions. Two questionnaires were targeted at PB and MT measurement and two questionnaires at CTD measurement. The first three questionnaires were used in several international studies, questioning different European, the USA and other country university students (Tobacyk, 1988; Moore, Rudd, & Penfield, 2002; Peltzer, 2003; Ricketts & Rudd, 2004; Irani et al., 2004; Diaz-Vilela, & Alvarez-Gonzalez, 2004; Roberts & Dyer, 2005; Sjodin, 2010). All three international scales were adapted to the Latvian language, first of all translating them from English into Latvian, and then the translator from the professional translation company retranslated the text back into English. This translation was sent to the authors of the scales for the approval. The approval was received by the authors of the scales. The study got permission from RSU Ethics Committee. Dissemination of the electronic questionnaire for research purposes was presented at RSU Deans' Council, where it got its approval. Support to do students' opinion poll was also received by RSU Students' self-government.

Four measuring instruments were used: *Magical Ideation Scale* (MIS) (Eckblad & Chapman, 1983), containing 30 statements; *Revised Paranormal Belief Scale* (RPBS) (Tobacyk, 1988), containing 26 statements; CTDAS (*EMI: Critical Thinking Disposition Assessment*) (Moore, Rudd, & Penfield, 2002), containing 26 statements; CTDES (*A.Utināns, G.Ancāne, J.Vētra, A.Villeruša, V.Cauce*, 2012), in which there were 30 statements. RSU Information technology service prepared the total electronic version of all 4 questionnaires.

The questionnaires “*Magical Ideation Scale*” (first 30 questions; the acquired response values may vary from minimum 0 till maximum 30) offered the choice “agree” or “disagree” on such themes as thought transmission experiences, belief in astrology, a sense of thought deprivation, such unusual feelings like the influence of a spirit, the conspiracy theory, UFO, a sense of reincarnation, expression of superstition for ensuring success and exchange of mental energy between the people.

RPBS – *Revised Paranormal Belief Scale* consisted of 26 statements with seven-point Likert type scale responses (the acquired response values may vary from minimum 26 to maximum 182), was divided into seven subscales: “Traditional religious beliefs”, “Psi beliefs”, “Belief in witchcraft”, “Precognition”, “Spiritualism” (all acquired response values may vary from minimum 7 to maximum 28), “Superstitions”, “Belief in extraordinary life forms” (in which the acquired response values may vary from minimum 7 to maximum 21).

Critical Thinking Disposition Assessment is a generalized scale (the acquired response values may vary from minimum 26 to maximum 130), which involved three subscales: “Engagement” (the acquired response values may vary from minimum 11 to maximum 55), “Cognitive maturity” (the acquired response values may vary from minimum 8 to maximum 40), “Innovativeness” (the acquired response values may vary from minimum 7 to maximum 35).

CTDES (the acquired response values may vary from minimum 24 to maximum 115) was made specifically referring to the sphere of faith and consisted of three subscales: “Truth-seeking disposition” (the acquired response values may vary from minimum 9 to maximum 45), “Open-mindedness” (the acquired response values may vary from minimum 9 to maximum 45), “Critical thinking self-evaluation” (the acquired response values may vary from minimum 6 to maximum 30) and offered the responses by five-point Likert system.

CTDES validity analysis developed by the study authors included: (1) factor analysis, (2) internal consistency with Cronbach' alpha coefficient, (3) comparison of the data with the internationally approbated CTDAS (Critical Thinking Disposition Assessment scale). CTDES subscales were evaluated, using the factor analysis of Varimax rotation method (Bartlett's test $\chi^2 = 3565$, $df = 496$, $p < .001$; Kaiser-Meyer-Olkin = 0.74), leaving 24 statements. Cronbach' alpha coefficient value increased from 0.66 (with 30 questions) to 0.87 and showed sufficient validity. Validity analysis was presented at RSU scientific conference in 2015.

Correlation of both scales by Pearson's correlation coefficient showed, that CTDAS and its subscale response values have a statistically significant positive association with CTDES response values. CTDAS subscale "Cognitive maturity", by which are measured respondents' predispositions to realize the problem complexity, to be open to different opinions and to understand one's own and other people's prejudices and predispositions, all in all showed a more pronounced positive association with CTDES ($r = 0.36$; $p < 0.001$), as well as with the subscales "Critical thinking self-assessment" ($r = 0.38$; $p < 0.001$) and "Open-mindedness" ($r = 0.30$; $p < 0.001$). Only the truth-seeking subscale response values did not show any statistically significant association with KDDIS, involvement and cognitive maturity subscale response values. Statistically significant positive association in the truth-seeking subscale response values was only with the international questionnaire of innovativeness subscale response values ($r = 0.08$; $p = 0.039$), by which are also measured the truth-seeking together with the disposition towards intellectual inquisitiveness. From MIS (magical ideation scale), selecting statements determined by purposeful procedures, an instrument was developed for measuring paranormal experiences (PE). There were selected those statements in which the respondents would admit, that he/she has experienced a kind of unusual experience.

In order the values of medical study programmes respondents opinion poll could be compared to the values of responses of respondents of other study programmes, as well as taking into account students' responsiveness, the acquired data were put together in three groups. The first group – “Medical study programme” – is formed by the respondents of the Faculty of Medicine and the Faculty of Dentistry. The criterion was the education in natural sciences and the prospective profession – a doctor. The second group was named “Health care study programme”, which was developed by putting together the opinion poll' data of the respondents from the Faculty Rehabilitation, the Faculty of Nursing, the Faculty of Public Health and the Faculty of Pharmacy. The merger criterion is the education in natural sciences in students whose future profession is not being a doctor, but a medical practitioner or a medical support person. The third group was named “Social sciences study programme group”, in which were included the respondents of the Faculty of Law, the Faculty of Communications and the Faculty of European studies. The criterion was the studies are not dealing with medicine and biology of the human body, and no emphasis is put on materialism and facts of physical studies, but on social sciences and public processes.

In the pilot study in 2011, the paper questionnaires were distributed to the students in RSU Psychosomatic clinic rooms. Within the first pilot project the paper questionnaire data were obtained from 116 RSU respondents of the Faculty of Medicine. The thesis was published, but the acquired data were presented at the RSU Scientific Conference in 2011.

Within the second pilot project, CTDES was added to the survey questionnaire, developing a complete questionnaire with four scales. The number of respondents was 149.

In the doctoral work there were used both the paper questionnaires distributed to student groups, and the electronic questionnaire survey data, which included the Magical Ideation Scale (MIS), Revised Paranormal Belief

Scale (RPBS), Critical Thinking Disposition Assessment (CTDAS) and Critical Thinking Disposition extra scale (CTDES). The poll took place from November 2011 till July 2012.

4. STUDY RESULTS

At the beginning the electronic questionnaires were filled in by 892 RSU respondents (13% of the total number of RSU students), however, the first MIS was completely filled in by 690 respondents (10%), the second RPBS was completed by 640 respondents (10%), the third CTDAS was completed by 610 respondents (9%), but the fourth CTDES was completed by 581 respondents (~ 9% of the total number of RSU students). Validity of all four questionnaire scales by Cronbach's alpha coefficient indices was in norm. MIS Cronbach's alpha value – 0.83; RPBS – 0.94; CTDAS – 0.87; CTDES – 0.87.

4.1. Mean values of the Medical study programme's respondents' responses and their proportion in the paranormal belief scales and subscales, which characterizes magical thinking, traditional religious beliefs and pseudoscientific beliefs

According to the scale's author, professor *Tobacyk's* methodology, the individuals who believe in the paranormal or traditional religion were determined, if the respondents' mean values of responses for the statement in Likert scale exceeded the mean value 4. The proportion of respondents of the Medical study programme, for whom the mean value exceeded the number 4, paranormal beliefs is more commonly expressed as belief in precognition (48.2%) and belief in witchcraft (44.6%) (see Table 4.3.), if all respondent responses are 100% (n = 496). The proportion of the individuals who believe in the paranormal of RSU respondents from the total population was 53.9%. The lowest number of students believed in superstitions (only 3.6%). From respondents of Medical study group, in comparison to any other TP (belief in the paranormal) subscale, a greater number of students were believers in traditional religion (52.2%).

Table 4.1.

Mean values of responses of the respondents of Medical study programme and the proportion of believers- respondents in the subscales of Revised Paranormal Belief Scale

Scale	Mean of scale	SD	Believers-respondents, number	Believers-respondents, %
Belief in witchcraft	15.17	5.95	221	44.6
Belief in Psī	13.71	5.49	158	31.9
Belief in spiritism	13.20	5.41	133	26.8
Belief in telling the future	13.66	5.25	239	48.2
Superstitions	6.32	3.17	18	3.6
Belief in unusual life forms	9.55	3.39	101	20.4
Belief in traditional religion	16.74	5.92	259	52.2

4.2. Mean values of critical thinking disposition and the proportion in Medical study programme respondents' responses

Mean values of Medical study programme respondents in CTD and the proportion were acquired with CT DAS and CTDES measuring instruments. In the CT DAS subscale "Cognitive maturity" the response values could vary from 8 to 40, in the subscale "Innovativeness" the response values could vary from 7 to 35, in the subscale "Engagement" the response values could vary from 11 to 55. The measuring instrument CTDES, in its turn, in the subscale "Open-mindedness" the response values could vary from 9 to 45, in the subscale "Truth-seeking" the response values could vary from 9 to 45, in the subscale "Critical thinking self-assessment" the response values could vary from 6 to 30. For Medical study programme the respondents of CT DAS (n = 477) the response mean value was 99.58 (SD = 10.13). In CTDES (n = 465) the response mean value was 81.47 (SD = 8.85). It was admitted, that the mean

values of responses, higher than 3, pointed to the positive critical thinking disposition (CTD). The proportion was determined of the respondents' responses with positive mean values of CTD. From all CTD subscales, the highest proportion of the positive CTD responses of Medical study programme respondents was fixed in the subscale "Cognitive maturity" – 96.9% (100% n = 477) respondents, but the lowest – in the subscale "Truth-seeking" – 64.1%, which was followed by the subscale "Critical thinking self-assessment" – 71.8% (where 100% n=465 respondents). (see Table 4.2.).

Table 4.2.

Mean values of Medical study programme respondents' responses and their proportion in the subscales of critical thinking disposition

Scale	Mean values	SD	Respondents with positive CTD values	
			number	%
Truth-seeking	29.83	5.91	298	64.1
Open-mindedness	30.25	5.24	393	84.5
Critical thinking self-assessment	21.40	2.89	334	71.8
Cognitive maturity	31.44	3.39	462	96.9
Engagement	42.59	5.23	446	93.5
Innovativeness	25.66	3.17	432	90.6

4.3. Comparison of mean values of Medical study programme respondents' responses by study years in the scales of magical thinking and paranormal beliefs

Comparison of mean values of Medical study programme respondents' responses by study years in reference to PB, MT, PE, as well as TRB did not show any statistically significant difference (see Table 4.3.).

Comparing the respondents' mean values of responses by study years, it turned out, that they did not essentially change. The mean values of students'

responses for TRB did not change. Only the comparison of mean values of responses of MIS and PE showed statistically significant decrease by study years, but the comparison of mean values of responses of MPPS subscale “Spiritualism” showed the decrease of numerical values within statistical significance range ($p = 0.05$).

Table 4.3.

Comparison of mean values of Medical study programme respondents’ responses by study years in the scales, connected with the beliefs

Measurement scale		Study year						
		1.	2.	3.	4.	5.	6.	> 6
MIS	Mean	9.6	10.5	9.8	9.1	8.4	8.3	6.7
	SD	5.10	5.88	5.16	3.81	5.18	4.06	4.48
RPBS	Mean	88.12	93.30	88.77	86.94	91.44	91.31	84.87
	SD	25.17	29.60	27.28	23.09	36.52	22.58	28.45
TRB	Mean	16.57	17.04	15.96	17.00	16.38	16.92	17.33
	SD	6.43	6.74	6.18	5.50	6.58	4.88	6.09
Psi Belief	Mean	13.53	15.02	13.25	13.46	14.56	15.51	12.35
	SD	5.58	5.99	5.20	5.28	7.11	5.05	5.50
Superstitions	Mean	6.1	6.4	6.3	6.7	6.6	6.0	5.9
	SD	3.0	3.1	3.0	3.5	3.4	2.6	3.1
Spiritualism	Mean	14.1	14.1	13.3	12.6	14.1	13.4	12.2
	SD	5.2	5.7	5.7	5.0	6.3	5.5	6.0
Extraordinary life forms	Mean	9.3	9.7	9.6	9.5	10.3	10.3	9.3
	SD	3.3	3.6	3.7	3.4	3.0	3.1	3.5
Belief in witchcraft	Mean	14.7	16.7	16.4	14.5	15.7	15.4	14.5
	SD	5.9	6.6	6.2	5.7	7.3	5.3	6.2
Precognition	Mean	13.9	14.4	13.9	13.2	13.9	13.7	13.4
	SD	5.7	6.1	5.3	4.8	6.3	4.7	5.5
Paranormal experiences	Mean	6.2	6.6	5.7	5.4	4.4	5.3	4.2
	SD	3.8	4.1	3.7	2.9	3.0	3.1	3.4
Number of respondents	MIS; PP	88	51	81	169	19	51	58
	MPPS	81	47	75	168	16	49	54

4.4. Comparison of mean values of Medical study programme respondents' responses by study years in the scales of critical thinking disposition

Medical study programme respondents' response values in dynamics by study years, in relation to CTD, did not show either positive, or negative statistically significant changes (see Table 4.4.).

Table 4.4.

Comparison of mean values of Medical study programme respondents' responses by study years in the scales of critical thinking disposition

Measurement scales		Study year						
		1. n=88	2. n=44	3. n=71	4. n=165	5. N=16	6. n=48	>6. n=52
CTDAS	Mean	99.8	97.6	101.0	98.7	101.7	100.3	100.0
	SD	10.7	10.9	10.1	10.2	13.6	9.1	8.3
CTDES	Mean	109.0	107.5	109.3	104.0	111.8	106.7	109.8
	SD	10.8	11.5	9.1	9.5	11.0	10.4	9.9
Innovative-ness	Mean	25.0	24.3	25.6	26.2	25.6	26.3	25.6
	SD	2.9	3.3	3.0	3.5	3.1	2.7	2.7
Engagement	Mean	42.4	42.3	43.7	41.8	43.8	42.8	43.0
	SD	5.9	4.8	4.8	5.3	7.5	4.8	4.6
Cognitive maturity	Mean	32.4	31.1	31.7	30.7	32.8	31.4	31.7
	SD	3.4	4.2	3.7	3.2	3.8	3.3	2.8
CT self-assessment	Mean	22.0	21.3	21.6	21.3	22.3	20.5	21.3
	SD	2.8	3.8	2.5	2.8	2.9	3.1	3.0
Truth-seeking	Mean	29.4	28.4	30.6	29.4	31.4	29.5	31.1
	SD	7.1	5.5	5.0	5.2	7.4	6.0	7.0
Open-mindedness	Mean	30.6	30.9	29.6	29.6	30.9	31.0	31.0
	SD	5.6	5.1	4.6	5.0	6.3	6.0	5.2

Only critical thinking self-assessment value decrease by study years showed statistical significance ($p = 0.049$).

4.5. The reciprocal associations of mean values of Medical study programme students' responses in the scales of paranormal beliefs and critical thinking disposition

The response values acquired in the study highlight a negative association between PB and CTD (see Table 4.5.). Pearson's correlation coefficient showed a statistically significantly weak, or moderately weak negative association between MIS, RPBS and the response values in the majority of subscales ("Psi belief", "Belief in witchcraft", "Superstitions", "Spiritualism") on one hand, and CTDES with two of its subscales ("Truth-seeking", "Open-mindedness"), on another hand. In "Truth-seeking" subscale the response values had a moderately negative association with the response values in the subscale "Traditional religious belief". CTDAS and its subscales ("Cognitive maturity" "Innovativeness", "Engagement") response values did not show statistically significant associations with MIS, MPPS and its subscale response values. Only in Superstitions subscale the response values were found to have statistically significant weak negative associations with all CTDAS subscale response values. The response values of the subscale "Critical thinking self-assessment" did not associate with either of RPBS subscale response values (see Table 4.5.).

Table 4.5.

Medical study programme respondents' response value associations in the scales of paranormal beliefs and critical thinking disposition

Scale/ number of respondents	CTDAS (n=471)	Innovativene ss	Engagement	Cognitive maturity	CTDES (n=460)	CT self- assessment	Truth- seeking	Open- mindedness
MIS (n=517)	0.04	0.02	0.02	0.05	-0.28	0.01	-0.29	-0.16
RPBS (n=490)	-0.00	-0.02	-0.01	0.02	-0.40	-0.07	-0.47	-0.12
TRB	-0.05	-0.04	-0.07	-0.02	-0.41	-0.09	-0.50	-0.08
Psi Belief	0.08	0.05	0.06	0.07	-0.28	-0.01	-0.32	-0.11
Belief in witchcraft	-0.00	-0.02	0.00	0.02	-0.32	-0.07	-0.39	-0.07
Superstitions	-0.15	-0.11	-0.12	-0.15	-0.27	-0.06	-0.21	-0.19
Spiritualism	0.07	0.04	0.04	0.11	-0.29	-0.03	-0.39	-0.02
Extraordinary life forms	0,04	0,02	0,04	0,03	-0,10	-0,02	-0,08	-0,07
Precognition	-0,04	-0,07	-0,04	0,00	-0,33	-0,06	-0,38	-0,10

4.6. Comparison of mean values of medical study programme respondents' responses with mean values of health care study programme and social sciences study programme students' responses

Comparing the mean values of MIS and RPBS in medical study programme, health care study programme and social sciences study programme group students, the dispersion analysis (ANOVA) showed a statistically significant differences of mean values of responses in MIS, RPBS and in the subscales "Belief in witchcraft", "Psi Belief", "Spiritualism", "Precognition", "Superstitions". Statistically significant differences were not seen in the mean values of response in the subscale "Belief in extraordinary life forms" ($p = 0.06$) and "Traditional religious beliefs" ($p = 0.08$) (see Table 4.6.). Such results, in accordance with the study hypothesis, were to be expected because

they differed just in the response values in the paranormal beliefs and magical thinking, while the mean values in TRB and with unrelated belief in magical thinking in extraordinary life forms did not essentially differ.

Table 4.6.

Comparison of mean values of study programme respondents' responses in the paranormal belief scales

Scale	Medical study group		Health care study group		Social sciences study group		p value
	n		n		n		
MIS	n	523	n	173	n	130	< 0.001
	Mean	9.0	Mean	10.0	Mean	11.9	
	SD	4.8	SD	5.1	SD	5.3	
RPBS	n	496	n	162	n	121	< 0.001
	Mean	88.4	Mean	97.9	Mean	101.7	
	SD	25.7	SD	24.9	SD	28.3	
Traditional religious beliefs	n	496	n	162	n	121	0.08
	Mean	16.7	Mean	18.0	Mean	17.0	
	SD	5.9	SD	5.7	SD	6.0	
Belief in witchcraft	n	496	n	162	n	121	< 0.001
	Mean	15.2	Mean	17.4	Mean	17.9	
	SD	6.0	SD	5.7	SD	6.2	
Psi belief	n	496	n	162	n	121	< 0.001
	Mean	13.7	Mean	14.8	Mean	16.4	
	SD	5.5	SD	5.4	SD	6.2	
Spiritualism	n	496	n	162	n	121	< 0.001
	Mean	13.2	Mean	14.6	Mean	16.0	
	SD	5.4	SD	5.2	SD	5.6	
Precognition	n	496	n	162	n	121	< 0.001
	Mean	13.8	Mean	16.0	Mean	16.7	
	SD	5.3	SD	5.1	SD	5.2	
Superstitions	n	496	n	162	n	121	0.001
	Mean	6.3	Mean	7.2	Mean	7.3	
	SD	3.2	SD	3.3	SD	3.5	
Belief in extraordinary life forms	n	496	n	162	n	121	0.060
	Mean	9.6	Mean	9.9	Mean	10.4	
	SD	3.4	SD	3.7	SD	3.5	

Multiple comparisons of mean values of student group responses, using Bonferoni correction, identified statistically significant mean value differences between both medical and health care study programme groups and social sciences study programme control group, but there were not found any statistically significant MIS mean value differences between medical study programme and health care study programme respondents. For medical study programme group the mean values of responses differed statistically significantly from social sciences study programme group' mean values ($p = 0.003$). However, by comparing medical study programme group with health care study programme group, the mean values of responses did not statistically significantly differ ($p = 0.077$). In social sciences study programme group the mean values of students' responses in MIS and RPBS showed to be higher. Similar relationship, where social sciences study programme group showed statistically significantly higher mean values of responses than both with medicine or natural sciences related study programme groups, were seen in the subscale "Psi belief" (with medical study programme group $p < 0.001$; with health care study programme group $p = 0.05$). So far the study hypothesis on the importance of the education in natural sciences was confirmed. However, such a difference in the mean values of responses in both natural sciences groups was not seen in all subscales. Medical study programme group showed statistically significantly lower mean values of the responses than the social sciences study programme group in RPBS ($p < 0.001$) and in the subscales "Belief in witchcraft" ($p < 0.001$), "Superstitions" ($p = 0.015$), "Spiritualism" ($p < 0.001$), "Precognition" ($p < 0.001$), but the mean values of responses in health care study programme group did not show statistically significant differences with social sciences study programme group in these indices. The respondents of medical study programme group showed statistically significantly lower mean numerical values than the respondents of health care study programme group in RPBS and in subscales "Belief in witschraft"

($p < 0.001$), “Superstitions” ($p = 0.009$), “Spiritualism” ($p = 0.013$), “Precognition” ($p < 0.001$).

Comparing various study programme groups by the mean indices of CTD scales, the dispersion analysis (ANOVA) showed statistically significant differences in mean values of responses in CT DAS subscale “Innovativeness” ($p < 0.001$), CTDES in total ($p = 0.02$) and in its subscale “Open-mindedness” ($p = 0.008$). In other subscales the mean statistical indices did not statistically significantly differ (see Table 4.7.).

Table 4.7.

Comparison of mean values of study programme group responses in the scales of critical thinking disposition

Scales	Medical study group		Health care study group		Social sciences study group		p value
CTDAS	n	477	n	156	n	116	0.051
	Mean	99.6	Mean	97.5	Mean	97.9	
	SD	10.1	SD	10.5	SD	11.3	
CTDES	n	465	n	149	n	107	0.020
	Mean	81.5	Mean	80.0	Mean	79.1	
	SD	8.9	SD	8.7	SD	9.8	
Innovativeness	n	477	n	156	n	116	< 0.001
	Mean	25.7	Mean	24.8	Mean	24.6	
	SD	3.2	SD	3.2	SD	3.4	
Engagement	n	477	n	156	n	116	0.455
	Mean	42.6	Mean	42.0	Mean	42.5	
	SD	5.2	SD	5.2	SD	5.3	
Cognitive maturity	n	477	n	156	n	116	0.118
	Mean	31.4	Mean	30.8	Mean	31.0	
	SD	3.4	SD	3.8	SD	4.2	
Critical thinking self-assessment	n	465	n	149	n	107	0.409
	Mean	21.4	Mean	21.2	Mean	21.7	
	SD	2.9	SD	3.4	SD	3.3	

Continuation of Table 4.7.

Scales	Medical study group		Health care study group		Social sciences study group		p value
	n		n		n		
Truth-seeking	n	465	n	149	n	107	0.201
	Mean	29.8	Mean	29.3	Mean	28.8	
	SD	5.9	SD	5.4	SD	6.6	
Open-mindedness	n	465	n	149	n	107	0.008
	Mean	30.3	Mean	29.5	Mean	28.6	
	SD	5.2	SD	5.2	SD	5.0	

Multiple comparison of groups, using Bonferroni correction, found statistically significant higher mean values in CTDES in the Medical study programme in comparison to the Social science study programme ($p = 0.036$), but did not find statistically significant differences in mean values between the medical and health care study groups. From CTDES subscales these statistically significant differences between the medical study programme and the social sciences study programme groups were seen only in the subscale “Open-mindedness” ($p = 0.009$). CTDES subscale “Innovativeness” revealed statistically significantly higher mean values in the medical study programme in comparison to the in social sciences study programme ($p = 0.004$), and in comparison to the health care study programme ($p = 0.011$). Statistically significant differences were revealed in the mean values in this Innovativeness subscale in the Health care study programme and Social sciences study programme ($p = 1.0$). In all other subscales and in CTDES, there were no statistically significant differences in the mean numerical indices between the Medical study programme and the Health care study programme and Social sciences study programme.

4.7. Association of other important factors with belief in the paranormal and critical thinking disposition

4.7.1. Comparison of mean values of students' responses by gender in the scales of belief in the paranormal and critical thinking disposition

Studies on MT and PB, carried out in the world, find differences in belief depending on the gender. Women show greater belief in MT and PB in comparison to men, but men show greater belief in pseudoscientific theories, such as, for instance, belief in extraordinary life forms.

In the current study, the mean values of medical study programme respondents' response scale show statistically significant differences, comparing the group dispersion by respondents' gender, using t test, which was found in all RPBS subscales (see Table 4.8.). In women, in comparison to men, the mean values were statistically significantly higher. MIS mean values did not statistically significantly differ, however, from MIS mean values of selected paranormal experiences in women, in comparison to men, they were statistically significantly higher ($p = 0.005$).

Table 4.8.

Comparison of mean values of Medical study programme respondents' responses by respondents' gender in paranormal belief scales

Scales	Gender				p value
	Men		Women		
MIS	n	113	n	410	0.272
	Mean	8.5	Mean	9.2	
	SD	4.9	SD	4.7	
RPBS	n	106	n	390	< 0.001
	Mean	78.7	Mean	91.0	
	SD	28.1	SD	24.4	
Traditional religious belief	n	106	n	390	< 0.001
	Mean	14.3	Vid.	17.4	
	SD	6.3	SD	5.7	

Continuation of Table 4.8.

Scales	Gender				p value
	Men		Women		
Belief in witchcraft	n	106	n	390	< 0.001
	Mean	12.6	Mean	15.9	
	SD	6.6	SD	5.6	
Psi belief	n	106	n	390	0.029
	Mean	12.8	Mean	14.0	
	SD	5.8	SD	5.4	
Spiritualism	n	106	n	390	0.003
	Mean	11.9	Mean	13.6	
	SD	6.0	SD	5.2	
Precognition	n	106	n	390	< 0.001
	Mean	11.1	Mean	14.4	
	SD	5.4	SD	5.0	
Superstitions	n	106	n	390	0.002
	Mean	5.5	Mean	6.5	
	SD	2.9	SD	3.2	
Extraordinary life forms	n	106	n	390	< 0.001
	Mean	10.6	Mean	9.3	
	SD	3.1	SD	3.4	
Paranormal experiences	n	113	n	410	0.005
	Mean	4.7	Mean	5.7	
	SD	3.3	SD	3.5	

The comparison of mean values of Medical study programme respondents' groups in CTD response scale, using t test, showed statistically significant differences between men and women (see Table 4.9.).

Table 4.9.

Comparison of mean values of Medical study programme respondents' responses by respondents' gender in critical thinking disposition

Scales	Gender				p value
	Men		Women		
CTDAS	n	99	n	378	0.006
	Mean	102.1	Mean	98.9	
	SD	9.1	SD	10.3	

Continuation of Table 4.9.

Scales	Gender				p value
	Men		Women		
CTDES	n	98	n	367	< 0.001
	Mean	84.5	Mean	80.7	
	SD	9.2	SD	8.6	
Innovativeness	n	99	n	378	0.021
	Mean	26.3	Mean	25.5	
	SD	3.3	SD	3.1	
Engagement	n	99	n	378	0.005
	Mean	43.9	Mean	42.2	
	SD	4.5	SD	5.4	
Cognitive maturity	n	99	n	378	0.257
	Mean	31.8	Mean	31.3	
	SD	3.1	SD	3.5	
Critical thinking self-assessment	n	98	n	367	0.001
	Mean	22.3	Mean	21.2	
	SD	2.9	SD	2.8	
Truth-seeking	n	98	n	367	< 0.001
	Mean	32.6	Mean	29.1	
	SD	5.9	SD	5.7	
Open-mindedness	n	98	n	367	0.220
	Mean	29.7	Mean	30.4	
	SD	5.0	SD	5.3	

Men showed higher mean values in the response scales, both in CTDES, and in CTDES, as well as in subscales “Innovativeness”, “Engagement”, “Critical thinking self-assessment” and “Truth-seeking”. No statistically significant differences were found in mean values of responses in the subscales “Cognitive maturity” and “Open-mindedness”.

4.7.2. Associations of paranormal experiences with belief in the paranormal or critical thinking disposition

Responses of RSU Medical study programme group respondents in PE scale showed, that more commonly there is marked either one, or five different types of senses. From 374 respondents either one, or five different types of senses had been marked by 43 respondents (each one 11.5%). 34 respondents have marked from their experience nine different unusual senses (9.1%). Maximum different number of senses was 18, and as it turned out, all of them had been mentioned by one respondent (0.3%). Only 24 respondents did not mark any of the given paranormal experiences in the scale (6.4%).

In the interrelationship of respondents' response values in PB, TRB and PE there were seen mean positive associations with all scale values (see Table 4.10.).

Table 4.10.

Reciprocal associations of paranormal beliefs, traditional religious belief and paranormal experiences

Scale	MIS (n=839)	PE (n=839)	PE31 (n=839)	PE32 (n=839)	PE33 (n=839)
MPBS (n=789)	0.66*	0.59*	0.30*	0.21*	0.25*
Superstitions	0.40*	0.36*	0.21*	0.06	0.17*
Spiritualism	0.62*	0.58*	0.30*	0.27*	0.24*
Extraordinary life form	0.44*	0.35*	0.18*	0.13*	0.12*
Precognition	0.56*	0.49*	0.22*	0.16*	0.19*
Psi belief	0.57*	0.50*	0.20*	0.20*	0.19*
Belief in witchcraft	0.53*	0.50*	0.27*	0.16*	0.21*
TRB	0.29*	0.27*	0.16*	0.09*	0.15*

*p < 0.05

By the statement in PE 31 “I have sometimes felt the presence of the dead person” related responses there was a mean positive association with thematically closer subscale “Spiritualism” ($r = 0.30$; $p < 0.001$) and “Belief in witchcraft” ($r = 0.27$; $p < 0.001$) response values. With the out-of-body experience PE 32 “I have sometimes had the feeling, as if I am leaving my body and watching myself from aside” related responses had weak positive associations with the subscale “Spiritualism” ($r = 0.27$; $p < 0.001$) response values. With clairvoyance statement PE 33 “I have had unusual feelings at some times, that my relative, who is far away, has got in a great trouble” related responses had weak positive association with the subscale “Spiritualism” ($r = 0.24$; $p < 0.001$), “Belief in witchcraft” ($r = 0.21$; $p < 0.001$) response values, and weak positive association with thematically closer subscale “Precognition” response values ($r = 0.19$; $p < 0.001$).

4.7.3. Comparison of mean values of respondents’ responses by the respondents’ confessional belonging, paranormal beliefs, traditional religious beliefs and critical thinking disposition in the scales and subscales

Comparing the mean values of the respondents’ response scale about PB being a member of a church confession or not, the independent selection t test of the scales and subscales showed, that the mean numerical values of responses of members of a confession in RPBS and subscales “Belief in witchcraft”, “Psi belief”, “Precognition” and “Superstitions” were statistically significantly higher than in those respondents, who considered themselves as nonmembers of a confession. The mean numerical values with MIS and PE related responses did not statistically significantly differ. As it could be expected, in the subscale “Traditional religious belief” the mean values were statistically significantly higher in the respondents who were members of a confession. From the critical thinking disposition subscales only in “Truth-seeking” subscale the mean values in members of a confession, as it could have

been expected, were statistically significantly lower, but the mean values of other subscales did not statistically significantly differed.

In order to determine, whether TRB decreases PB, there were studied Pearson's correlation between these subscales and membership to a confession. In the study it was found, that all RSU, and only medical study programme respondents, in TRB subscale positively correlated with all PB subscales. If we compare TRB indices with the most widespread paranormal belief type – belief in witchcraft, then it turned out, that 28.2% (n = 96) of those respondents, who believe in the possibility of witchcraft, do not show any pronounced belief in the concepts of traditional religion, but 71.8% of believers in witchcraft (n = 244) believe also in the concepts of traditional religion. And the opposite – only 28.7% of those who believe in the concepts of traditional religion (n=98), do not believe in witchcraft, but the rest of 71.3%, admitting the concepts of traditional religion, believe in witchcraft, too.

238 of RSU medical study programme respondents had mentioned, having acquired the secondary education in the city, while 77 respondents mentioned, that they had acquired the previous education in small towns and rural areas. The venue of acquiring the previous education did not show any statistically significant differences in mean values of MT, PB and CTD characteristics.

4.7.4. Association of students' response values between distress, chronic illness, a sense of loneliness and belief in the paranormal and critical thinking disposition

The results of the study show, that the response values of MIS scale are statistically significantly associated with chronic illness, it is markedly positively associated with the lately increasing stress and a sense of loneliness. RPBS was positively associated with chronic illnesses and markedly positively with a sense of loneliness. In the response values of medical study

programme group respondents, in all with belief in the paranormal-related subscales there was seen a positive association with a chronic illness, except for belief in unusual life forms. Also TRB response values had a positive association with a chronic illness. Such an assertive positive association with a chronic illness was not seen in the rest of study programme groups. The response values of medical study programme respondents in the subscales “Precognition”, “Superstitions”, “Belief in witchcraft” and “Spiritualism” were positively associated with a sense of loneliness. The PE response values for medical study programme group were positively associated both with chronic illnesses, and distress, and a sense of loneliness.

The response values in CTDAS were negatively associated with the increasing distress and a sense of loneliness. The response values in CTDAS subscales, “Engagement” and “Innovativeness” were negatively associated with the increasing stress and a sense of loneliness. The response values in CTDES were negatively associated with a sense of loneliness. The values of open-mindedness subscales were negatively associated with a chronic illness and a sense of loneliness. The response values in Truth-seeking subscale did not show a statistically significant association either with a chronic illness, or with an increasing stress, or a sense of loneliness. Critical thinking self-assessment did not have any negative associations with distress. In total, we can conclude, that a sense of loneliness had more negative associations with CTD components.

5. DISCUSSION

The study results show, that, despite the scientific thinking, acquired at RSU medical study programme, which is materialistic (1), because the study process deals with getting detailed knowledge in the structure and functioning of the human body, by studying anatomy, physiology, histology, etc., the knowledge of the causality process at different levels; (2) the education is targeted at studying facts, where each theory has to be proved or falsified; (3) it is oriented towards the tests developed by colleagues in other countries on the correctness of conclusions, a part of students, however, are still maintaining unscientific thinking. This being quite a different thinking, called paranormal, magic, intuitive, is oriented to (1) nonmaterialistic supernatural, magic causalities, which are not confirmed by experimental facts; (2) different theories of different intellectual authorities or ancient writings in modern versions, which are not experimentally proved or cannot be falsified.

As a whole, the proportion of PB of all RSU respondents, as well as medical students, has to be rated by total parameters of all scales as being below the average. Results of subscales allow us to conclude, that the proportion of those respondents in the medical study programme who believe in witchcraft is 44.6%. The individuals from medical study programme respondents who believe in precognition, appeared to be slightly higher – 48.2%. All in all, PB in its significant degree was not encountered in either medical study programme respondents, but a pronounced belief in witchcraft was encountered in 8.1% respondents.

According to the data acquired, both in RSU students-respondents' population as a whole, and in medical study programme students, the lowest was the percentage of superstitions, i.e., a belief, that a black cat, a broken mirror or the number 13 can bring a disaster. The low percentage of superstitions could be explained with CT activity on one hand, because a

student, quite empirically, can check the discrepancies of the data, besides, superstitions are not disseminated or popularized by the authorities, who would argue for the opposite.

The proportion of psi belief, which is considered to be “the most scientific” of all paranormal beliefs, was found to be 31.9% respondents, most often pointing to the fact, that respondents have not taken interest in attempting to prove the paranormal phenomena.

Belief in extraordinary life forms by hypothesis was added to pseudoscientific views, because it does not include MT directly – causalities of spiritual energy activity unknown to science, but quite materialistic phenomena. In the study it was presented by materialistic aliens ship, Loch Ness lake plesiosaur or a snow man. The proportion of belief here was 20.4% of medical study programme respondents. Other authors, however, add the belief in extraordinary life forms to belief in the paranormal. The data of the current study confirm the last mentioned version, because belief in extraordinary life forms statistically significantly positively was associated with PE ($r = 0.35$; $p < 0.001$), MIS ($p = 0.44$; $p < 0.001$), psi belief ($r = 0.50$; $p < 0.001$), belief in witchcraft ($r = 0.38$; $p < 0.001$), superstitions ($r = 0.26$; $p < 0.001$), spiritualism ($r = 0.47$; $p < 0.001$), precognition ($r = 0.39$; $p < 0.001$). The possible conclusion is – there is a greater possibility, that materialistic pseudoscientific theories will be believed by an individual, who has magical thinking and belief in the paranormal phenomena.

Positive CTD proportion in medical study programme respondents was in about 90% respondents. We can judge from these data, that belief in magic and paranormal phenomena, as well as in CTD, exist in parallel to one another. There is an indirect implication that, despite the high CTD proportion, respondents’ belief in the paranormal is not so low, as it might be expected. The results do not contradict to the studies done elsewhere, when, for instance, cognitive abilities and thinking disposition do not exclude thinking biases. The

extent of thinking disposition, for instance, openness of mind, anticipates the capability of overcoming of prejudices only as being potentially possible, rather than being inevitable (Macpherson, Stanovich, 2007).

All CTDES subscale results had a lower proportion, in comparison to CTDES subscales – open-mindedness 84.5%. CT self-assessment 71.8%, truth-seeking 64.1% of all responses. It is interesting, that of all CTD subscales the lowest numbers are in truth-seeking subscale, which agrees with other studies in the world, although there was used a different – California CTD evaluation scale. The study data show, that for 35.9% of RSU respondents, who answered negatively to truth-seeking scale's included statements, more important is the opinion of intellectual authorities, rather than the empirical facts. It could be interpreted as follows, that equally high CTD and PB characteristics demonstrate, that students are lacking CT skills for the assessment of scientific accuracy as well, since 71.8% respondents had marked their CT self-assessment being above the average, therefore it would be important for students to understand, how CT is used in sciences, which explore a human psyche, behaviour and psychosomatics and how to attribute it all to oneself.

In the current study the mean values of students' responses in MT and PB scales did not show statistically significant differences by study years. It means that those students, who at the start of studies are having higher or lower belief level, most commonly will be at the same level also at the end of studies. Although this was a cross-sectional study, the hypothesis, that students preserve the same belief level throughout the study years, is the most possible. Most commonly the belief in magic is necessary for having a sense of life or stress control, and for this reason it is not abandoned, and, in order to evaluate it, no scientific criteria acquired during the studies are used.

Study results of some foreign authors prove, that both CT skills, and CTD can be increased [Rimiene, 2002; Pai & Eng, 2013]. The current study results prove that only in Innovativeness subscale there was observed a

statistically significant improvement of the result by study years. According to the current study data, a similar CTD level is shown both by the final year students and residents, and respondents of the initial stage of studies. It indicates, that, if CT skills are not specially taught at the university, and if their usage in testing paranormal phenomena is not actively discussed, one cannot expect the decrease of MT and PB proportion.

Checking the interrelated associations of mean values of PB and CTD responses of medical students, the current study data show, that for a part of students truth-seeking and open-mindedness disposition is negatively associated either with PB, or with traditional religious belief, but for a different student part CTD exists in parallel to PB. Those respondents, for whom both RPBS, and CTDES values were above the average, admit, that, although the facts are more important than the opinions of the authorities or scriptures, the trust, however, in the opinions of various intellectual authorities is still preserved (n = 81 or ~ 28% of respondents of the Medical study group).

The negative association between PB and CTD in relation to the openness of mind and truth-seeking can be interpreted as mutually competitive interrelation of these tendencies, at least to some extent, as it has been suggested in the neural darwinism theory (Edelman, Tononi, 2000). For the majority, CTD has a tendency to abandon (more often only subconsciously, not consciously) MT and PB. CTDES made the respondents choose, whom to give the preference – to the intellectual authorities or to scientific facts, therefore a more clearly identified negative association between MT, PB and CTD developed.

In the open-mindedness disposition, i.e., readiness to change one's opinion and to abandon outdated views, there was seen a demonstrative negative association with PB, as it was expected. It might mean, that just the resistance to abandon the previous views creates a significant disposition of CT. CT self-assessment percentage of being above the average, as well as

decreased mean values in the last years, are evidently identifying the fact, that part of respondents do not know, how to evaluate one's CT abilities in relation to magic. The conclusion drawn shows, that 44.6% of respondents' responses express belief in witchcraft, but total believers in the paranormal phenomena are even much more.

In comparison – in a social sciences study programme group, where study programmes do not envisage acquiring details in materialistic (molecular) knowledge, the mean numerical values of students' responses showed a statistically significant higher magic ideation level when measuring by MIS, and a greater belief in the paranormal when measuring by RPBS. These results correspond to the study results in the world, in which social sciences students had been fixed a higher MT and PB level (Gray & Mill, 1990; Aarnio, Lindeman, 2005). However, the mean values of Health care study programme respondents' responses did not show a statistically significant difference in RPBS subscales, in comparison to Social sciences study programme respondents, which does not allow us fully assert, that the education in natural sciences is affecting belief in the paranormal.

Evaluating the influence of other important factors of RSU students on the magic or critical type of thinking, the study results showed statistically significant differences of mean values of responses by genders, which coincide with the results of other studies done in the world (Haraldson & Houtkooper, 1996; Goode, 2000; Aarnio, Lindeman, 2005). In the data of studies done in the world, men statistically more often show belief in extraordinary life forms (Dag, 1999; Goode, 2001). MIS did not depict differences between genders like it was seen also in other studies (Fonseca-Pedrero and coauthors, 2009).

MIS did not show that the greater part of magic ideations and PB are due to psychopathologic factor, if Eckblad and Chapman criteria are used. Schizotypy, both positive, and negative, is exposed only in a small part of respondents – 3.5% (4.6% men and 3.2% women). Intuitive thinking system is

a wider concept of schizotypy, while intuitive thinking disposition, as considered by many contemporary scientists, to a greater or lesser extent is characteristic of all people. Numerical values of PB and PE showed a significant positive association, which can be interpreted in the way, that the intuitive internal paranormality plays a significant role for many respondents. Therefore the theory of intuitive thinking system, which has developed during the process of brain evolution, seems to be the best of MT and PB interpretation. The dual process theory, related to it, contrasting the competition of the intuitive and logical thinking system, is a good theoretical basis for the data acquired in the current study. The dual process theory can be perceived as a direct connection with neural darwinism theory of Edelman, a Nobel Prize winner in neurosciences (Edelman, Tononi, 2000). This, still, does not exclude the possibility, that the outer environment might influence the respondents, who have never experienced anomalous, paranormal experiences. In the latter case the scientists are of the mind, that the decisive factor is suggestibility and even hypnotibility, which was not measured in the current study. However, the results of the current study do not give the answer to the question, whether there are any respondents whose thinking had been influenced only by social factors. These results coincide also with Adelaide University psychology students' study results, which prove, that the greater role is paid to mystical experiences, rather than to specific psychopathology (Thalbourne, 2007).

The question got actualized in the study on the interaction between CTD and PE. A statistically significant negative association was found out between PE and CTDES truth-seeking subscale, which says, that a part of students possess a tendency not to take into consideration scientifically acquired facts, but to remain under the influence of previous experiences and to interpret these experiences or unclear physiological feelings in the way, how it had been suggested by experts in the paranormal, or by intellectual authorities, or relatives. Besides, statistically significant mean values of students in the

subscale “Paranormal experiences”, the negative association with the mean values in the subscale “Open-mindedness”, can be interpreted like a resistance to give up pseudoscientific theories under the influence of new facts, if the internal feelings can interpret the paranormal phenomenon in the assertive way. Respondents may not be interested in the interpretation types of alternative and non-paranormal feelings. Such respondents’ reaction can be interpreted like mental seclusion.

The fact, that there were not found assertive negative associations of PE values with CTDAS and its subscales, might indicate, that an individual, who feels PE, is greatly interested in it, is reading about it, thus showing greater innovativeness values. The knowledge is, nevertheless, used to get explanations for the paranormal of one’s strange feelings. The interest is focussed on paranormal and magical literature, but not on scientific or psychological explanations. It is possible, that psychological explanations of PE (illusions, wrong thinking) by such a respondent are perceived as unpleasant, therefore not taken for granted. Perhaps PE does not influence an individual’s ability to make responsible and rational decisions, or, perhaps, a respondent does not perceive it like that.

The current study data do not confirm the theory, that TRB is essentially decreasing PB, which is in line with those studies where the results have proved a positive association between PB and TRB (Haraldsson, 1981; Schumaker, 1990; Dawkins, 2006).

The study results do not prove any essential effect of the secondary education on PB, or on CTD, depending on the fact, whether the respondent is from a rural or a small town school, or from a city school. This partially confirms results of a study carried out abroad (Frank, 1930), but it does not coincide with the studies, in which there are still found the differences (Snow, 1983; Lopez, 2005).

The study results show, that for Medical study programme groups, the chronic illnesses, a sense of loneliness and increasing stress are positively associated with MT and PB, especially in belief in witchcraft, superstitions, spiritualism, psi belief and precognition, as well as PE. The positive association of a sense of loneliness with superstitions confirms the results of those studies, which prove, that nonbelievers-students are more introvert (Thalbourne, Haraldsson, 1980). The results of the doctoral thesis coincide with RPBS author, professor *Tobacyk* study on PB, alienation and anomia in the USA college students. In the study of the USA students, in which feelings of alienation were measured by a special *Alienation Scale* (Dean, 1961), students with the depressive feeling showed a positive association with the subscale “Superstitions” and “Spiritualism”, but no positive, nor negative association was found with the subscales “Traditional religious belief” and “Belief in witchcraft” (Tobacyk, 1985).

The results of the current study most commonly confirm MT, PB and CT biopsychosocial model. Humans possess different dispositions – either belief in magic and in the paranormal, or in CT (Geertz, Markusson, 2010).

CONCLUSIONS

From all 6667 RSU students, 690(~ 10.3%) respondents participated in electronic opinions poll.

1. Study hypophesis was confirmed, stating that part of medical study programme respondents (slightly below 50%) are found to have slight or moderately marked magical thinking and paranormal beliefs, both at the beginning of studies, and at the end of studies. Indices of paranormal beliefs and magical ideations for all students were, in general, below the average. The higher distribution from paranormal beliefs (the number of believers in %) among RSU respondents of the Medical study group was the belief in precognition (48.2%) and belief in witchcraft (44.6%), but the lowest distribution in superstitions (3.6%). 8.1% respondents' subscale "Belief in witchcraft" showed a marked degree of belief. A greater number of believers was in traditional religions (52.2%) over believers in the paranormal.
2. Students-respondents of the Medical study group showed high and average numerical values of critical thinking disposition, which is similar to mean values of other university students (especially in the USA).
3. Magical thinking, paranormal beliefs and pseudoscientific assumptions are mostly preserved unchanged throughout all study years. In the current study no significant increase of CTD by study years was found either in the students of the Medical study group, or in RSU students in total, which did not confirm the study hypothesis.
4. The gap of dynamics either in belief in the paranormal, or critical thinking disposition did not allow us to find a clear answer, whether the increase of critical thinking disposition would influence or not influence the level of magical thinking and paranormal beliefs. The

answer of the study is that critical thinking disposition and magical thinking functions go in parallel to each other. In part of respondents the greater critical thinking disposition correlates with belief in the paranormal negatively, but in another part – both magical thinking and paranormal beliefs, and critical thinking disposition are coexisting consciously. Perhaps, the only way to achieve the interaction between them is to work specially at it and to increase CTD and CT skills.

5. In the study data there were found statistically significant differences of mean numerical values for the Medical study group, in comparison to Health care study group and Social science study group. Orientations of natural sciences in the Medical study group and Health care study group did not essentially differ the level in belief in the paranormal of the respondents from the comparable group of the Faculties of Social Sciences.
6. Assessing the influence of important psychodynamic factors of other RSU students on the type of magical or critical thinking, there was found an intricate picture. All in all, women were of higher percentage to demonstrate their belief in the paranormal in comparison to men. From the acquired study data, we can see, that belief in traditional religion and confessional belonging do not essentially affect magical thinking and paranormal beliefs, and those who belong to a certain confession showed a higher level of paranormal beliefs. No statistical differences, in its turn, were found among those who had acquired secondary education in small towns and big cities. Schizotypy, as a possible psychopathology, is seen only in a small part of respondents. Intuitive internal paranormalities (in the study called as paranormal experiences) play a significant role for many respondents. In a part of respondents there were encountered anomalous experiences, which statistically significantly were associated either with belief in the

paranormal, or belief in traditional religion. The study found, that a sense of loneliness and increasing distress are positively associated with magical thinking and paranormal beliefs, especially in superstitions, spiritualism, psi belief and precognition, but did not associate statistically significantly with subscales in traditional religion and belief in extraordinary life forms.

PRACTICAL SIGNIFICANCE OF STUDY

1. During the work at doctoral thesis, three international survey questionnaires were adapted to the Latvian language–*Magical Ideation Scale* (Eckblad & Chapman, 1983)), *Revised Paranormal Belief Scale* (Tobacyk, 1988)), EMI: Critical Thinking Disposition Assessment (Moore, Rudd, & Penfield, 2002)).
2. *Revised Paranormal Belief Scale* was validated for the Latvian version in international reference publication Utinans A., Ancane G., Tobacyk J.J., Boyraz G., Livingston M.M., Tobacyk J.S. Paranormal beliefs of Latvian college students: A Latvian version of the Revised Paranormal Belief Scale // *Psychological Reports: Measures & Statistics*, 2015; 116(1): 1-11.
3. During the work at the doctoral thesis there was developed a new measuring instrument – Critical thinking disposition extra scale. New scale was validated, as presented in RSU scientific conference in 2015.

PRACTICAL RECOMMENDATIONS OF STUDY

A great majority of scientists are of the mind, that students should be taught to apply CT in different disciplines and different contexts, even teaching multidisciplinary course (Lai, 2011, referring to Halpern, 2001). CTD, if judging from other studies, can change. The development of CTD is affected by the university environment open to all kind of knowledge and avoid of prejudices in discussions. It would be worth explaining to students about the subject, concept, meaning of critical thinking and to teach CT skills. The disposition to critical thinking can change along with the growth of interest about the idea of developing such features in oneself. The interest might increase by understanding the meaning of learning the truth, when the learning of truth, at least for the part of students, may become the meaning of life, and in such a way the search for the meaning of life would not be substituted by other illusory constructions. Although the faith and placebo healing is existing comparatively broadly, it is important for the medical students, future doctors, to understand the importance of finding the real causes of health, disease and impairments.

1. When teaching students scientific thinking and evidence-based medicine, one should focus more on the criteria, by which theories are devaluated and dropped as invalid.
2. Presumably, the disposition of this critical thinking and skills development call for a separate, specially-created study programme.
3. The question has to be analyzed as to teaching of scientific conceptions of spirituality to medical students. For medical students it would be important to understand the difference between a healthy and pathological spirituality, and how these views give a contribution into the development of a man's health or disease. The analysis of theoretical ideas of non-traditional or alternative medicine would be

important for students to promote critical thinking, and a certain tolerance and recognition of the useful. Such knowledge for future doctors can be of use understanding the treatment of oncological patients and severely ill somatic patients. There is a special – positive, or negative role in the alternative treatment for such psychic disorders as schizophrenic disorder, obsessive-compulsive disorder, depressive disorder, anxiety disorders and disorders caused by addiction to chemical substances.

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