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# **COMPARATIVE ANALYSIS OF CRITICAL THINKING SKILLS OF UNIVERSITY STUDENTS IN DIFFERENT YEARS OF STUDY OF TWO COURSES OF STUDY AT THE FACULTY OF EDUCATION IN LJUBLJANA**

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## **Abstract**

Critical thinking is recognized as one of the key professional competences. In our study, we wanted to research whether there were differences in critical thinking skills among the students entering the faculty, concerning some of their socioeconomic and educational characteristics, whether there were differences in critical thinking skills among students of two courses of study, as well as differences in critical thinking among the first-year and third-year students of each course of study, because the results could show the effects of courses of study on the ability of the graduates in this respect. Among the most important conclusions of the research we should emphasize that there were significant differences between the scores of the first-year students in relation to completed secondary school, that there were no differences in critical thinking among the first-year students of two courses of study, that these differences in the third-year students were significant, and that the first-year and third-year students of two courses of study practically showed no progress in critical thinking skills (except in one sub-test). Final conclusion would be that it would be necessary to introduce in study more specific content and different teaching styles, which would encourage critical thinking skills among students.

**Keywords:** critical thinking, skills, evaluation, study progress

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## **Introduction**

There seems to be no general agreement on the concept of critical thinking in sciences dealing with this topic (psychology, philosophy, pedagogy). There are a number of concepts with similarities and differences between them. O'Rourke (2005), classifies various concepts into two groups: a. critical thinking as an ability to analyse, evaluate and design arguments (this group includes mainly authors in the field of philosophy, e.g. Bowel & Kemp, 2002), and b. critical thinking defined in terms of skills, processes of thinking, procedures (e.g. Facione et al., 1990; Paul, Binker, Martin, Vetrano & Kreklau, 1989).

Moon (2008) distinguish different conceptions of critical thinking, "writers have used, consciously or not consciously in order to work with the complexities of critical thinking for the purpose in hand." (p. 35) Her work give the base for Rupnik Vec (2011) categorization of perspectives in the field:

Critical thinking as the ability to use the informal logic: a critical thinker is the person who skilfully formulates, analyses and evaluates both his own and others' arguments (e.g. Bowel & Kemp, 2002; Cottrell, 2011).

Critical thinking as the whole of emotional and motivational dispositions and cognitive skills: a critical thinker is the person who skilfully uses a range of cognitive skills (e.g. identifying problems, analysing assumptions, assessment in accordance with the criteria, etc.) at the same time, so he is characterized by a variety of emotional and motivational orientations (confidence in the intellect, intellectual honesty, courage and integrity, many perspectives, etc.) (e.g. Ennis, 1985; Facione et al., 1990; Halpern, 1996; Paul et al., 1989; Wade & Tavis 1996).

Critical thinking as the ability to use various thinking processes and cognitive strategies: a critical thinker is the person who skilfully uses a sequence of thinking processes and procedures, based on which he systematically analyses answers to the research questions (e.g. Pellegrino, 1995; Sternberg, 2001).

Critical thinking as the highest stage in the development of thinking: a critical thinker is the person who has reached the highest level in his mental development; he realizes that reality is contextually conditioned, and his reasoning and evaluation processes are based on probabilistic and contextually defined criteria (e.g. Kitchener, 2002; Kuhn, 2000).

Critical thinking as a social and reflective practice: a critical thinker is the person who actively participates in a democratic society, who raises awareness of injustice and actively opposes to it (e.g. Burbules & Berk, 2006; Giroux, 2006; Ten Dam & Volman, 2004).

Critical thinking as self-reflective practice: a critical thinker is the person who is able to constantly reflect on his own thinking, experience and behaviour in terms of the basic assumptions and values and is aware of the contextual conditionality of his own decisions and the tendency to cognitive delusions and prejudice, which he is trying to overcome (e.g., Brookfield, 1993; Levy, 1997).

Among the above-mentioned perspectives there are no clear dividing lines, resulting in many overlaps, but there are also differences in the aspect of thinking to which primary attention is given. Clear understanding of critical thinking has important implications for practical use, because it determines both the strategies of educational work at different levels of education and the approaches to monitoring and evaluation of the effects thereof (Ennis, 1985; Van Gelder, 2005).

In this paper, for the purpose of the research of the progress in critical thinking of female and male students of two courses of study at the Faculty of Education, we understand critical thinking as the unity of cognitive skills and emotional and motivational dispositions of individuals.

### **Models of critical thinking skills**

In the professional literature there are a variety of models of critical thinking skills, which vary in their complexity, from simple sets of skills (e.g. Wade, 1995; Starkey, 2004), to more complex, hierarchical models (e.g. Ennis, 1993; Paul et al., 1989).

One of the simplest models identifies eight critical thinking skills. Wade (1995) identifies: a. asking questions/constant questioning, b. defining a problem, c. examining evidences, d. analysing assumptions and biases, e. avoiding emotional reasoning, f. avoiding oversimplification, g. considering other interpretations and h. tolerating ambiguity. In addition to cognitive skills, the model also includes motivational and emotional characteristics of critical thinking (e, f and h).

An interesting, simple and useful model is Bonstingl's model (1996). The author classifies critical thinking skills into three major groups: a. identifying and clarifying a problem, b. assessing information, c. making decisions and solving problems. Identifying and clarifying a problem

means clear defining of problems, identifying facts contained in a piece of information, creation of quality questions, comparing and determining the relevance of information for a given context. Assessing information means distinguishing facts from opinions and conclusions, examining consistency, recognizing assumptions, distinguishing right from wrong images (e.g. stereotypes), recognizing propaganda, disorders and ideologies. Making decisions and solving problems means identifying causes and consequences, predicting consequences, identification of alternatives, showing reasonable assessment and making and examining conclusions.

There are other models as well, e.g. Facione et al. (1990), Marzano et al. (1988), Paul et al. (1989), Starkey (2004). Although the lists of basic skills are different, the most commonly cited are the following: identifying problems (problem identification, question formulation and / or research problem), judgement (to judge: information, relevance of problems, power of argument, etc.), distinguishing facts from opinions, and inferences/conclusions. This finding represents one of the starting points for the design of Critical Thinking Assessment Test in our study.

### **Critical thinking as one of the key competences of studying**

According to numerous studies, critical thinking represents a key professional competence that should be included in undergraduate studies (Chabrak & Craig, 2013, Halx, Reybold, 2005 Niu, Behar-Horenstein, Garvan, 2013, C. Wilkin, 2017), so it seems to be one of the most important educational achievements with which the students would complete their studies (Holt, Young, Keetch & Larsen Mollner, 2015; Facione, 2015).

For this reason, in a number of higher education schools, critical thinking has been included in their curriculums and regarded as key competence that the students should acquire during the studies. Due to this widely accepted attitude, some authors have already recognized it as an implicit characteristic or even as a “mantra” of higher education (Halx, Reybold, 2005).

At the same time, Bartos and Banks (2016, p. 36) point out that critical thinking has a paradoxical status. On the one hand, it has been recognized as the most important group of skills, which should be achieved at the university level, on the other hand, it is often sidelined. A similar conclusion has been made by Moore (2013) and Wilkin (2017), who consider that critical learning should not be taught directly, but included in other teaching content. Bartos and Banks (2016) describe the model as Osmosis model, since it is expected that students will

absorb critical thinking on their own from a variety of teaching content, the same way as it happens with water osmosis, instead of being taught critical thinking directly. Consequently, it turns out that, although critical thinking can be learned (Cotrell, 2011; Facione, 2015; Halpern 1996), on the other hand, students often demonstrate poor critical thinking strategies (A. Heijltjes, T. Van Gog & Paas, 2014; Flores, Matkin, Burbach, Quinn & Harding, 2012). The above discussion encouraged us to examine the situation regarding explicitly required critical thinking skills and/or competences in the study of social pedagogy and pre-school education at the Faculty of Education in Ljubljana.

### **Measurement of critical thinking skills**

Research of critical thinking has been topical for nearly half a century. The authors have been studying a wide range of issues, from conceptual (e.g. what critical thinking is), through the phenomenological (e.g. the extent to which critical thinking is widespread in different populations) to the experimental issues (the extent to which critical thinking skills are general or contextually conditioned, how much they are transferable from one context to another, what the factors of the development of critical thinking skills are, etc.) In this paper, our aim is to research differences in critical thinking of students of two courses of study at the Faculty of Education and to examine whether students make progress in critical thinking skills during the studies. Similar topics have been researched in few studies abroad (e.g. Chabrak & Craig, 2013; Çubukçu, 2006; Eigenberger, Sealmader, Jacobs & Shellady, 2001; Genc, 2008; Grosser & Lombard, 2008; Halx & Reybold, 2005; Niu , Behar-Horenstein & Garvan, 2013; Troff, 2005 by Wilkin, 2017). Various tests were used in these studies.

One of the tests of critical thinking skills, used in some of these studies, as well as in the study on the effectiveness of critical thinking in Slovenian teachers (Rupnik Vec, 2009), was the Watson-Glaser Critical Thinking Appraisal Test (1980). It consists of five sub-tests that measure critical thinking skills of an individual: reasoning, recognizing assumptions, deduction, interpretation and evaluation of arguments. Having taken this test for our model, we made some modifications and developed the critical thinking appraisal test for Slovenian students.

### **Research in the field of critical thinking**

In the last twenty years there are different areas of research in the field of critical thinking, for example: Is critical thinking generic ability or is it discipline-specific ability? (Ikuneobe, 2001; Solon, 2007) How effective is explicit teaching of critical thinking (students know that they are learning to think) in comparison to implicit teaching of critical thinking

(tasks demand critical thinking but students are not aware of it)? (Solon, 2007; Zohar & Peled, 2008) How effective are different teaching methods in developing critical thinking of students? (Frijters, Ten Dam & Rijlarsdam, 2008; Ozturk, Muslu & Dicle, 2008) What are the differences in critical thinking between different groups of students (sex, age, study programs, socio-economic status etc.). (Cubukcu, 2006; Cheung, Rudowicz & KwanYue, 2002; Eigenberger, 2001; Genc, 2008; Grosser & Lombard, 2008). Some of the conclusions of these researches are used in interpretation of results in this study.

### **Research Objectives**

The study period is a period of intensive development of knowledge and skills relevant to professional performance. One of the most important skills of professionals is the area of effective thinking, which is characterized by criticality and problem-solving skills. In this study, we have researched differences in critical thinking skills among the first-year and third-year students of two courses of study at the Faculty of Education in Ljubljana (future social pedagogues and preschool educators). At the same time, we were interested in differences in critical thinking skills among students entering the faculty with respect to certain socio-economic and educational characteristics. In this regard we set the following hypotheses:

### **Hypotheses**

Hypothesis 1: Among the achievements of the first-year students of two courses of study at the Faculty of Education in Ljubljana, being researched, in the sub-tests of the Critical Thinking Assessment Test and in the total test score, there are differences according to the achieved secondary school education, final school success and education of mother and father.

Hypothesis 2: Between the students of the two courses of study at the Faculty of Education in Ljubljana, there are differences in critical thinking skills as well as in the general critical thinking ability.

Hypothesis 3: There are differences among the achievements of the first- and third-year students of two courses of study at the Faculty of Education in Ljubljana, being researched, in the sub-tests of the Critical Thinking Assessment Test and in the total test score.

### **Method**

#### **Participants**

We used purposeful sampling. According to the objectives of the study, we included in the sample all first-year and third-year female and male students of preschool education and social pedagogy courses of study



at the Faculty of Education in Ljubljana, who were present on the day of testing. Thus, our research involved the total of 100 students, as follows: 37 students (out of 63 enrolled) the first-year students (3 male, 34 female) of preschool education, aged 19-21  
19 students (out of 39 enrolled) the first-year students of social pedagogy (all female), aged 19-20,  
19 students (out of 51 enrolled) the third-year students of preschool education (1 male, 18 female), aged 20-23 and  
25 students (out of 31 enrolled) the third-year students of social pedagogy (1 male, 24 female), aged 21-24.

### **Research instruments**

For the purposes of the research, we have developed an instrument, namely Critical Thinking Assessment Test (CTAT). It consisted of five sub-tests that measure the following skills: identifying problems, recognizing assumptions, evaluating arguments, distinguishing facts, opinions, and conclusions and making conclusions. Each sub-test consisted of 15 issue tasks, and the candidate could reach from 0 to 15 points. The maximum score of the whole test was 75 points. The sub-tests construction followed to Watson-Glaser Critical Thinking Appraisal test (1980), therefore, the test have the construct validity. The subtests in the CTAT are: Recognizing assumptions, Evaluating arguments, Distinguishing facts, opinions and conclusions and Making conclusions. The sub-test Identifying and defining problems were designed in accordance with Starkey (2004). Tasks in sub-tests of CTAT evoke some of the specific higher order thinking processes, which are in core of the critical thinking skills models (e.g. Ennis, 1985; Facione et. all, 1991; Halpern, 1996) Some authors (Watson and Glasser, 1980) claim that critical thinking tests should be content-free tests, namely they shouldn't presuppose any field-specific knowledge for the person to be able to complete the test tasks. So CTAT tasks differentiate from the WGCTA tasks according the content but inside the subtests they are of the same type.

Tasks of the sub-test Identifying problems require the ability to detecting or recognizing of the issues i.e. differentiation of the real issues from the imaginary issues, e.g. .: "Which of the following situations does not require a solution, i.e. in not a real problem: a. The children who were on a picnic where you took them, were dissatisfied because they were feeling bored. b. On the Internet, a picture of a child was found showing the child in an unfavourable light. "

Tasks of the sub-test Recognizing assumptions asses the ability to recognize the implicit premises that enable making a conclusion, e.g. .:

"The statement below is followed by an assumption. You should determine whether the assumption is contained in the statement or not. The statement: Long-term voluntary activities and voluntary contributions reduce the responsibility of the government in supporting vulnerable categories of population. Assumption: The government will invest in these areas less and less because non-governmental organizations will take care of them."

Tasks of the sub-test Evaluating arguments require distinguishing between weak and strong arguments, e.g. .: "The question below is followed by two arguments. Mark each one as either strong or weak. In the context of this test, consider each argument to be true. Make sure that your personal attitude regarding the issue does not affect your assessment of the strength of the argument. Question: In order to make students more capable, should each university exam consist of written and spoken part? Argument A: Yes, because only in this way can a professor adequately examine different aspects of the student's knowledge. B. ..."

Tasks of the sub-test Distinguishing facts, opinions and conclusions verify whether the candidate understands the concepts of fact and opinion or conclusion, i.e. can distinguish them, e.g.: You should determine which of the following statements refer to the fact, which refer to opinion and which represent a conclusion. The correctness of statements is not important. Statement: Poljšak Škraban (2004) states that children's development is mostly influenced by family environment."

Tasks of the sub-test Making conclusions, test the ability of assessment, i.e. whether a given conclusion follows from the given premises or not, e.g.: "Here is a number of premises, followed by several conclusions. Read the premises and judge whether the conclusion follows from them, or not. In the context of this test and for the purposes of this test all premises should be regarded as true. Premises: All children growing up in permissive mode, enjoy running barefoot through the puddles and mud. All children growing up in permissive mode, catch worms, snakes and other insects without hesitation. Conclusion: Some children, who catch worms, snakes and other insects without hesitation, enjoy running barefoot through the puddles and mud."

The reliability of the test measured by Cronbach's alpha for the whole test is 0.58. The reliability is low, but it is comparable to the reliability of the Watson - Glaser Critical Thinking Appraisal Test (1980), which was reported by the authors to be measured on different samples resulting in the range between 0.55 to 0.85 (Watson & Glaser, 1980; Godzella, 2002). It would certainly require further exploration to improve the metric

characteristics of the test. The highest score to correlate with the total score was achieved in the sub-test Recognizing assumptions ( $r=0,69$ ,  $p<0,001$ ), following Identifying problems ( $r=0,65$ ,  $p<0,001$ ), Making conclusions ( $r=0,62$   $p<0,001$ ), Distinguishing of facts, opinions and conclusions ( $r=0,61$ ,  $p<0,001$ ) and Evaluating arguments ( $r=0,49$ ,  $p<0,001$ ).

### **Collection and analysis of data**

In first step we investigated the extent to which the concept of the critical (and its derivations) appears in the objectives and competences of different subjects in both examined courses of study.

The test was performed in January 2017 at the premises of the Faculty of Education. We invited all the students present at that time who were attending the first and the third year of preschool education (PV) and social pedagogy (SP) courses. As at the time of the first test (due to the upcoming holidays) there were only 8 students from the third year of SP (less than 30%), we gave the questionnaire to the remaining students in early February 2017. None of the students refused to participate in the study. The obtained data were analysed with the statistical program SPSS 22.0, using the correlation coefficient, t-test and multiple analysis of variance (MANOVA).

## **Results**

1. Required critical thinking skills and/or competences in the study of social pedagogy and pre-school education at the Faculty of Education in Ljubljana.

We found that the Faculty has only one optional subject that directly teaches critical thinking (Developing strategies for critical thinking), which was not launched in 2016/17, and that critical thinking is (at least partially) covered by one of the general competences of the university graduates (Criticality and self-criticality). In individual subjects of the study of social pedagogy, the following skills are mentioned: critical treatment of activities in different areas of the socio-educational work, critical understanding of various phenomena, criticism of individual theories, critical aspects of research, critical thinking about own professional development. In the curriculum of preschool education the following skills are listed: critical analysis of educational work (as one of the fundamental objectives of the program), critical evaluation and application of theories (one of the subject-specific competencies), critical analysis of practice, critical judgment of discourse, critical evaluation of various educational experiences, teaching criticism and self-criticism. And additionally: critical analysis of basic motor skills elements, critical evaluation of theoretical knowledge, critical evaluation of walking, critical evaluation of the principles of safety and health planning, critical evaluation of different methods of learning to swim. It is particularly interesting that the last six competences refer to the subjects associated with physical activity (motor skills, exercise, mountain climbing and swimming).

Based on the teaching experience in the both courses of study, we can assume, similarly as Bartos and Banks (2016), Moore (2013) and Wilkin (2017), that critical thinking is encouraged indirectly, in particular by means of writing reflections on thinking, feeling and acting, evaluations of different things etc., while direct teaching of critical thinking to students has probably not been performed.

Table 1: Scores of the CTA test regarding a course of study and year of study (numerus, aritmetična sredina, standardna deviacija) (numerus, arithmetic mean, standard deviation)

CTAT Subtest	course of study	year of study	N	$\bar{x}$	SD
Identifying problems	PE (preschool education)	1.	37	9,92	2,32
		3.	19	10,00	1,15
		total	56	9,95	1,99
	SP (social pedagogy)	1.	19	10,84	1,34
		3.	25	10,72	1,94
		total	44	10,77	1,69
	Total	1.	37	10,23	2,08
		3.	19	10,41	1,67
		total	56	10,31	1,90
	Recognizing assumptions	PV	1.	37	9,62
3.			19	10,26	3,17
total			56	9,84	2,44
SP		1.	19	10,58	2,43
		3.	25	11,28	1,88
		total	44	10,98	2,14
Total		1.	37	9,95	2,16
		3.	19	10,84	2,54
		total	56	10,34	2,37
Evaluating arguments		PV	1.	37	11,54
	3.		19	11,37	1,80
	total		56	11,48	1,91
	SP	1.	19	12,58	1,83
		3.	25	12,52	1,26
		total	44	12,55	1,51
	Total	1.	37	11,89	1,98
		3.	19	12,02	1,60
		total	56	11,95	1,82
	PV	1.	37	8,27	2,30
3.		19	8,32	1,94	
total		56	8,29	2,17	

Distinguishing facts & opinion	SP	1.	19	8,42	1,89	
		3.	25	8,56	1,66	
		total	44	8,50	1,74	
	Total	1.	37	8,32	2,15	
		3.	19	8,45	1,77	
		total	56	8,38	1,98	
	Making conclusions	PV	1.	37	8,16	1,81
			3.	19	8,74	2,28
			total	56	8,36	1,98
SP		1.	19	8,37	2,19	
		3.	25	10,40	1,70	
		total	44	9,52	2,16	
Total		1.	37	8,23	1,93	
		3.	19	9,68	2,12	
		total	56	8,87	2,13	
Total	PV	1.	37	47,51	6,87	
		3.	19	48,68	5,94	
		total	56	47,91	6,54	
	SP	1.	19	50,79	5,13	
		3.	25	53,48	4,66	
		total	44	52,32	5,00	
	Total	1.	37	48,63	6,48	
		3.	19	51,41	5,71	
		total	56	49,85	6,28	

The results show that there are differences among all subtest (and total scores) in the Critical Thinking Assessment Test regarding a course of study (social pedagogy students achieve higher scores). The third-year students achieve higher results than first-year (with the exceptions on two subtests: Identifying problems where the first-year preschool education students achieve higher results than the third-year and Evaluating arguments where the first-year students achieve higher results than the third-year in both courses of study).

2. Differences among students in the Critical Thinking Assessment Test in respect to the education level of their father and mother, their final secondary school success, and the completed secondary school programme.

In this section, we check the hypothesis 1, which presupposes the existence of differences in the results of the first-year students of two courses of study at the Faculty of Education on the Critical Thinking Assessment Test scale, as well as in the total score of the test in respect

to education level of their father and mother, their final success in secondary school, and the completed secondary school education.

According to the literature references (e.g. Cheung, Rudowicz, Kwan in Yue, 2002), various environments and experiences (type of school, family characteristics, etc.), have impact on multiple cognitive performance (e.g. academic success, general intellectual ability, etc.) of an individual. Accordingly, we assumed that it would also apply to the students' scores in the critical thinking assessment test in our sample. In that part of the analysis we included only the first-year students of two courses of study at the Faculty of Education, because we believed that their later studying experience would significantly improve their critical thinking (the second hypothesis verified).

Table 2: Differences in critical thinking in the first year depending on the mother's education (numerus, arithmetic mean, standard deviation, t-value, degrees of freedom)

CTAT	Mother's education	N	$\bar{x}$	SD	t	df
Identifying problems	High	18	10,94	1,86	1,65	53
	Low	37	10,00	2,04		
Recognizing assumptions	High	18	10,22	2,36	0,53	53
	Low	37	9,89	2,06		
Evaluating arguments	High	18	12,67	1,97	1,97*	53
	Low	37	11,57	1,92		
Distinguishing facts, opinions and conclusions	High	18	8,94	2,69	1,17	53
	Low	37	8,14	1,72		
Making conclusions	High	18	8,11	1,87	-0,28	53

	Low	37	8,27	2,01		
Total	High	18	50,89	5,94	1,69	53
	Low	37	47,86	6,32		

\*p<0,05, \*\*p<0,01

Table 3: Differences in critical thinking in the first year depending on the father's education (numerus, arithmetic mean, standard deviation, t-value, degrees of freedom)

CTAT	Father's education	N	$\bar{x}$	SD	t	df
Identifying problems	High	16	10,88	1,82	1,34	53
	Low	39	10,08	2,07		
Recognizing assumptions	High	16	10,50	2,36	0,96	53
	Low	39	9,79	1,89		
Evaluating arguments	High	16	12,75	1,73	2,02*	53
	Low	39	11,59	2,00		
Distinguishing facts, opinions and conclusions	High	16	8,94	1,81	1,22	53
	Low	39	8,18	2,19		
Making conclusions	High	16	8,44	1,90	0,53	53
	Low	39	8,13	1,99		
Total	High	16	51,50	4,94	2,05*	53
	Low	39	47,77	6,54		

\*p<0,05, \*\*p<0,01

The results show statistically significant differences between the first-year students according to the level of education of their mother, in the sub-test Evaluating arguments (Table 2) ( $\bar{x}_1 = 12,67$ ,  $SD = 1,97$ ;  $\bar{x}_2 =$



11,57, SD = 1,92; t = 1,97, p< 0,05), and regarding the father's education, we found differences in the sub-test Evaluating arguments ( $\bar{x}_1 = 12,75$ , SD = 1,73;  $\bar{x}_2 = 11,59$ , SD = 2; t = 2,02, p< 0,05) as well as in the total score of the test ( $\bar{x}_1 = 51,50$ , SD = 4,94;  $\bar{x}_2 = 47,77$ , SD = 6,54; t = 2,05, p< 0,05) (Table 3). Higher scores were achieved with students whose parents had higher education.

In our further consideration we checked, by means of the t-test, differences among the first-year students scores in relation to the completed secondary school and secondary school final success.

Table 4: Differences in critical thinking in the first-year students of two courses of study regarding the completed secondary school (numerus, the arithmetic mean, the standard deviation, the t-value, degrees of freedom)

CTAT	Secondary school	N	$\bar{x}$	SD	t	df
Identifying problems	Gramm.	23	11,13	1,39	3,11**	54
	Vocat.	33	9,61	2,26		
Recognizing assumptions	Gramm.	23	10,26	2,37	0,90	54
	Vocat.	33	9,73	2,02		
Evaluating arguments	Gramm.	23	12,39	2,01	1,58	54
	Vocat.	33	11,55	1,92		
Distinguishing facts, opinions and conclusions	Gramm.	23	8,74	1,95	1,21	54
	Vocat.	33	8,03	2,27		
Making conclusions	Gramm.	23	8,39	2,16	0,51	54
	Vocat.	53	8,12	1,78		
Total	Gramm.	23	50,91	5,01	2,28*	54
	Vocat.	33	47,03	6,96		

\*p<0,05, \*\*p<0,01

The results show that there are no significant differences among the first-year students' scores in the Critical Thinking Assessment Test regarding their secondary school final success - neither in the whole test

nor in individual sub-tests (results are not show in the table). However, there are significant differences in the score regarding the completed secondary school (table 3). The analysis of average scores shows that students having completed grammar school (gymnasium), compared with students with completed secondary vocational schools, achieved in all sub-tests higher scores: differences are statistically significant only in the sub-test Identifying problems ( $\bar{x}_1 = 11,13$ ,  $SD = 1,39$ ;  $\bar{x}_2 = 9,61$ ,  $SD = 2,26$ ,  $t=3,11$ ,  $p<0,01$ ), and in other sub-tests they are not. At the same time, these differences culminate in statistically significant difference between the results of the two groups in their total scores in the test ( $\bar{x}_1 = 50,91$ ,  $SD = 5,01$ ;  $\bar{x}_2 = 47,03$ ,  $SD = 6,96$ ;  $t = 2,28$ ,  $p<0,05$ ) (Table 4).

Conclusion: Hypothesis 1 was partly accepted, because we found some differences regarding the mother's and father's education and some differences regarding secondary education, but we did not find differences between the students depending on their final secondary school success.

### 3. Differences in the scores of students in Critical Thinking Assessment Test regarding the course of study and the year of study

In this section, we checked the second and the third hypothesis by which it is assumed that there are differences between students of different courses of study, who as a rule, completed different secondary school programs (relation between the completed secondary school and the faculty course is high:  $\Phi = 0,83$   $p < 0.001$ ), as well as the differences between the students of different years of the same course of study, because we assumed that the studying experience has a positive impact on a person's critical thinking skills.

First, we examined the adequacy of data for conducting the multivariate analysis of (MANOVA) variance: conceptual coherence of dependent variables, with low to medium correlations (Griego & Morgan, 1998). The analysis of correlations performed between the sub-tests of the Critical Thinking Assessment Test, showed the adequacy of the data for the implementation of MANOVA, as correlations between sub-tests range from 0.05 to 0.30, which, according to Field (2005), represents low to medium connections.

With MANOVA, we examined the effects of two independent variables (course of study, year of study) and their interactive effects on a group of dependent variables (the results of sub-tests of the Critical Thinking Assessment Test and the total score in the test).

Table 5: Differences in the scores of the CTA test regarding a course of study and year of study

MANOVA	CTAT Subtest	X2	df	F	Sig.
Course of study	Identifying problems	15,67	1	4,39	0,04*
	Recognizing assumptions	22,62	1	4,22	0,04*
	Evaluating arguments	27,83	1	8,89	0,00**
	Distinguishing facts & opinion	0,90	1	0,22	0,63
	Making conclusions	20,28	1	5,27	0,02*
Year of study	Identifying problems	0,01	1	0,00	0,95
	Recognizing assumptions	10,46	1	1,95	0,16
	Evaluating arguments	0,31	1	0,09	0,75
	Distinguishing facts & opinion	0,19	1	0,04	0,82
	Making conclusions	39,42	1	10,25	0,00**
Course of study * year of study	Identifying problems	0,24	1	0,06	0,79
	Recognizing assumptions	0,02	1	0,00	0,95
	Evaluating arguments	0,07	1	0,02	0,87
	Distinguishing facts & opinion	0,05	1	0,01	0,91
	Making conclusions	12,32	1	3,20	0,07

We found that there was a strong multivariate effect of a course of study on the score of the Critical Thinking Assessment Test ( $F = 3.33$ ,  $p < 0.01$ , Wilks' Lambda = 0.85), but no effect of the year of study on the score of the Critical Thinking Assessment Test, except in the sub-test Conclusion ( $F = 10.25$ ,  $p < 0.01$ ) (Table 4). There was also no significant interactive influence of a course of study and the year of study on any of the studied dependent variables.

A more detailed analysis (Table 5) shows that the scores of students of both courses of study are significantly different in all sub-tests except in the sub-test Distinguishing facts, opinions and conclusions (Identifying problems:  $F = 4.39$ ,  $p < 0.05$ ; Recognizing assumptions:  $F = 4.22$ ,  $p < 0.05$ , Evaluating arguments:  $F = 8.89$ ,  $P < 0.01$  Making conclusions:  $F =$

5.27,  $p < 0.05$ ). There is also a significant difference in the total score of the test ( $F = 10.88$ ,  $p < 0.01$ ).

Conclusion: We can accept the hypothesis 2 because there are significant differences between the students depending on the course of study. Hypothesis 3, where we examined the differences between the first-year and third-year students regarding their scores in the Critical Thinking Assessment Test, was, however, rejected, because it showed difference only in one the sub-test in students of one course of study.

## **Discussion**

In this study, we examined three hypotheses, one was accepted in full and two in part. The first hypothesis was formed on the basis of the studies that identify the impact of several variables on the performance of critical thinking of different social groups, mostly students of different courses of study. Genc (2008) identifies the correlation of socio-economic status and critical thinking skills of students; Cheung, Rudowicz, Kwan Yue (2002) cite the influence of the profession of the father on critical thinking of children. Based on this, we made an assumption that in our cultural context, the education of mother and father, the final school success and secondary school education of parents, contribute to the differences in critical thinking of the examined female and male students, which was partially confirmed. Due to the small numerus in connection with this hypothesis, we do not want to generalize, but only to identify potential direction for further research. Concerning the result of the sample, i.e. the obtained difference in critical thinking skills in one sub-test concerning the mother's education, and a difference in one of the sub-tests as well as in the general score of the test concerning the father's education, the above mentioned direction in further research might confirm, with greater certainty, and on a larger number of first-year students of several courses of study, the existence of such differences and – indirectly – an assumption, that patterns of thinking that an individual is exposed to in his family environment with higher parental education, will have effects on the quality of cognitive functioning.

Several studies suggest that there are differences in students' scores in the Critical Thinking Test concerning previous education (Çubukçu, 2006) and study experience (course of study for students or education of graduates) (Çubukçu, 2006; Eigenberger, 2001; Genc, 2008; Rupnik Vec, 2009). Our assumption that significant differences will be found among the students having different previous education, has been confirmed. Students with completed secondary vocational school have achieved lower scores, compared with students having completed the

grammar school, in all sub-tests, and significantly lower scores in the sub-test Identifying problems as well as in the total test score. More demanding grammar school program therefore represents a more effective encouragement for critical thinking skills, particularly in identifying problems, to which may also contribute the requirements of the final exam (research paper) that represent the best opportunity for development of critical thinking. Enrolment in the grammar school program, in our educational system, in terms of opportunities, i.e. the encouragement for critical thinking, represents probably a better choice. But we also can interpret these results in different way, namely with possible differences in students' general abilities: in grammar schools probably enter students with higher abilities as in vocational schools. An interesting research question for further investigations could be asked: how much critical thinking correlate with general ability of students?

The other two hypotheses (concerning the population, i.e. the number of students enrolled in each academic course), we examined on a large sample, for which reason our conclusions are more relevant.

The second hypothesis was formed on the basis of the findings regarding the impact of courses of study on the disposition of critical thinking in students. Various studies found really significant differences between the students of different courses of study (Çubukçu, 2006; Eigenberger, 2001; Genc, 2008). Multiple analysis of variance showed the importance of the effect of a course of study on the scores in four out of the five sub-tests (evaluating arguments, making conclusions, identifying problems, recognizing assumptions), and the analysis of variance showed the differences in the total score. We can therefore conclude that the diversity of experiences in a particular course of study, actually contributes to the differences in critical thinking skills, in our case in favour of the study of social pedagogy. At the same time, we found that among the first-year and third-year students of pre-school education, there were no statistically significant differences either in any sub-test or in the total test score. Among the first-year and third-year students of social pedagogy there was a significant difference only in the sub-test Making conclusions, but in the total test score there was no difference. Assuming that generations of enrolled students at the beginning of their studies were equal in critical thinking skills – we have concluded that the students' experience in both courses of study does not contribute to the development of the researched skills, i.e. in both courses of study critical thinking skills are not being paid enough attention. In part, this result is surprising for us, since we expected the students to make progress in several critical thinking skills (especially

due to some methods used in their studies – e.g. a lot of reflections, encouraging dialogue, evaluation, etc.).

This result can be explained by the fact that in both courses of study there are no subjects explicitly teaching critical thinking, as well as the fact that these skills are also very rarely found in the set of competences of individual subjects. Several authors (Bartos & Banks, 2016; Ikuenobe 2001; Solon, 2007; Wilkin, 2017), highlight the importance of explicitness in the teaching of critical thinking, which means that the teaching of critical thinking should be made clear, and after the teaching, the reflection on the thinking process should be enabled or encouraged in accordance with the criteria. Abrami (2008 in Van den Brink-Budget, 2016) in a meta-study about the most effective strategies for the improvement of critical thinking finds that the combined approach gives the best results: teaching critical thinking as an individual subject along with the explicit teaching of critical thinking included in other subjects. In our interpretation, it means teaching critical thinking as a phenomenon along with promotion of critical thinking within the most diverse topics within courses of study as well as by continuous focusing on the analysis and evaluation of own thinking, which is, in fact, the central element of the concept of a critical thinker as defined by some authors (e.g. Paul et. al., 1989).

### **Conclusion**

Taking into account the limitations present in this study, we can conclude that on the students' individual skills and overall ability of critical thinking, the fact which secondary school they previously attended has a significant impact. Consequently, we can see that among the first-year students of both courses of study the differences are small, which however, substantially increase by the third year of study, which is attributed to the impact of the studies itself. In general, we can conclude that the two courses of study do not have sufficient direct content and different methods that could explicitly and implicitly encourage individual critical thinking skills in general (because the first-year and third-year students do not make progress as much as we would like and expect them to do).

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