

A Research on Critical Thinking Tendencies and Factors that Affect Critical Thinking of Higher Education Students

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Abstract

This study was conducted to determine the relationship between critical thinking tendencies and levels and the factors that affect the critical thinking tendencies of higher education students. In the study, critical thinking tendencies of freshman and senior students were analyzed depending on demographic features, faculties and departments.

The research was done on the students of Uşak University. In the study, the data collected through surveys were analyzed through regression analysis in order to determine the effects of the dependent and independent variables; frequency and percentage values, reliability, item factor analysis, KAISER-MEYER-OLKIN: measure of sampling adequacy test, Bartlett's test of sphericity using SPSS 18.0.

Keywords: thinking, critical thinking, critical thinking tendency, critical thinking dimensions, higher education, university students, demographic features

1. Introduction

The power of the societies has long been thought that it results from different sources. Information society represents an era when learning is perceived as life style on individual, organizational and social bases and information qualifies as a strategic resource. In this period, basic priorities of the individuals are redefined as “to manage the future, which build new ideas which make a difference” (Demirel, 2007, p. 226). This definition foregrounds the demand of individuals who improve themselves and solve problems rather than the people who continuously create problems in everyday life. Critical thinking receives considerable attention due to the interest in employees who have certain creative cognitive skills which are appraised by the industry and business world being the engines of the social change (Özden, 2005, p. 160).

Critical thinking being a process which requires *research, intuition, logic, experience and universal values* gives individuals the ability of recognizing one's own errors and biases as well as an efficient decision making (Kökdemir, 2012, p. 16). In this respect, individuals who have the tendencies of critical thinking can cause differences in economics and social studies having higher cognitive skills (Erdemir & Koç, 2009, p. 159–160). However, there is not enough recent studies on critical thinking in Turkey and for this reason studies on critical thinking would contribute to the development of interdisciplinary researches.

2. Thinking and Critical Thinking

2.1 The Concept of Thinking

Thinking, generally, refers to *the signification of the world in which one lives, recognizing his or her existence, telling right from wrong, searching for absolute truth and happiness in one's inner world through meaning* (Özden, 2005, p. 139).

Thinking, which distinguishes mankind from other species, is a concept that has meanings depending on the content and perspective. Therefore, thinking is “*an active and organized cognitive process which is used to be*

able to recognize the situation in which one exists” (Cüceloğlu, 1994, pp. 37), “a cognitive process which is based on recollection, reasoning, problem solving and criticism” (Taşcı, 2005, pp. 77) and “a skill which gives individuals how to make comparison and contrast through unique actions, separations and combinations, and deductions as well as apprehending shapes” (Kökdemir, 1999, pp. 4–5).

As is seen, thinking is a skill which allows people to understand the current situation and then relate to other situations and deduct something. Also thinking is producing meanings from around the world relating to oneself and nature as a result of research and observation. Although thinking is an innate capacity, it is teachable and learnable. Therefore, thinking can be improved as a basic competence.

Thinking abilities can be categorized as “basic operations, problem solving, decision making, critical thinking and creative thinking” (Serefoğlu & Akbıyık, 2006, p. 193–197; Denk, 2011, pp. 90).

- Basic operations: “*cause-effect analysis, resemblance, classifications and qualification*”.
- Problem solving: “*overcoming a prominent outstanding unsolved difficulty, combining the known facts about the problem, deciding on the data to be collected for the problem, producing solutions, testing the solutions and seeking simpler expressions for the problems*”.
- Decision making: “*gathering information, identifying alternatives, choosing from alternatives*”.
- Critical thinking: being different (Table 1) from regular thinking is a skill which enables one to look at things from different angles (Berber et al., 2007, pp. 7–8).

Table 1. Differences between critical thinking and regular thinking

Regular thinking	Critical thinking
Guessing	Making decision
Preferring	Appraisal
Grouping	Classifying
Believing	Presumption
Understanding	Understanding logically
Associating	Comprehension principles
Underlining correlations	Making notes of other correlations
Uttering assumptions	Uttering evidential thoughts
Taking unjustifiable decisions	Taking justifiable decisions

Source: (Aybek, 2007).

2.2 The Concept of Critical Thinking

Critical thinking, dating back to Socrates, is qualified as “*ethical power guiding to virtue*” and “*logical way of thinking which guides our attitudes*”. “*Having been defined as describing facts correctly*” today, critical thinking has many other definitions in the literature (Serefoğlu & Akbıyık, 2006, p. 195).

Glaser (1985), conceptualized critical thinking in three ways (i) “*an attitude based on foreseeing and solving problems*”, (ii) “*having the capacity of deduction and reasoning*”, and (iii) “*being able to put all these methods into practice in daily life*” (Glaser, 1985, pp. 24–27).

In this definition, attitudes of the individuals relating to thinking action have been underlined. Moreover, even though one possesses the skill and knowledge concerning critical thinking, one may not be able to perform critical thinking if his or her attitudes are not supported by critical thinking.

Chance (1986), defined critical thinking as “the skill to analyze facts, generate and organize ideas, defend opinions, make comparisons, draw inferences, evaluate arguments and solve problems” (Güven & Kürüm, 2006, p. 79).

Norris and Ennis (1989), define critical thinking as “reasonable reflective thinking focused on deciding what to believe or do” (Ricketts & Rudd, 2004, pp. 62).

Paul (1992), defines critical thinking as “one must think about what he has been thinking about in order to improve his or her thinking”. In the definition, critical thinking does not only focus on “*the way of thinking*”, but also “*what factors matter in order to improve oneself*” and furthermore, it is advised that “the individual has to improve his or her way of thinking through standards which are used while thinking” (Paul, 1996, pp. 54–55).

Cüceloğlu (1994), explains critical thinking as “*an active and organized cognitive process which enables us to be conscious of our own thinking processes, to take into consideration others’ thoughts, to practice what we have learned and understand ourselves as well as surrounding*”(Cüceloğlu, 1994, pp. 35).

Critical thinking is the use of those cognitive skills and strategies that increase the probability of a desirable outcome... purposeful, reasoned and goal directed—The kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions

Halpern (1996) defines critical thinking as “*the use of cognitive skills and strategies that increase the probability of a desirable outcome... purposeful, reasoned and goal directed*”. Acquisition and use of those skills and strategies are accepted as the conditions for the performance. Hence, critical thinking differs from other types of thinking, especially in cognitive skills and strategies which are involved in processing information (Kürüm, 2002, pp. 65).

On the other hand, according to Pascarella and Terenzini (1990) “critical thinking involves the individual’s ability to do some or all of the following: identify central issues and assumptions in an argument, recognize important relationships, make correct inferences from data, deduce conclusions from information or data provided, interpret whether conclusions are warranted on the basis of the data given, and evaluate evidence or authority” (Ricketts & Rudd, 2004, pp. 62).

In light of these approaches, critical thinking can be defined as “an ability of making effective decisions, solving problems, observing our own thoughts and a process which is based on research, intuition, logic and experience and universal values”.

Critical thinking emerges as “a complex and comprehensive process that require a higher order of cognitive skills”.

Dressel and Mayhew (1954) have listed the following to display the importance of the concept of critical thinking (Güven & Kürüm, 2006, pp. 80–81):

- The ability is especially significant for transferring information that involves ethical and spiritual values and raising children.
- The ability creates knowledge which is not randomly produced, but relevant and promising.
- The ability plays an important role to solve problems and draw valid conclusions and judge the validity of inferences
- The ability has a long term influence on knowledge retention.

One may get disillusioned with unproductive decisions due to the fact that some thoughts lack critical thinking (Gouran & Hirokawa, 1983, p. 107). Critical thinking is a factor which enables individuals to lead a more productive and independent for a better life (Munzur, 1999, pp. 61).

2.3 Critical Thinking Traits and Critical Thinker Characteristics

The traits of critical thinking compared to uncritical thinking have been defined as relevancy, validity, openness, logicality, truthfulness and fairness (Amnon & Baruch, 2007, pp. 10–11).

Eight characteristics of critical thinking were identified by Wade: Asking questions, defining a problem, examining evidence, analyzing assumptions and biases, avoiding emotional reasoning, avoiding over interpretation, considering other interpretation, tolerating ambiguity (ERIC Digest, 1988).

Paul (1992) suggests critical thinkers to ask themselves the following questions (Paul, 1996, pp. 95–102):

- What is the purpose of my thought?
- Is the question (problem) which I struggle to answer clear enough?
- In what kind of point of view should I think about?
- What concepts or ideas constitute the center of my thought?
- What assumptions do I try to put forward?

- What knowledge will I use (data, truths, observation)?
- How should I comment on this information?
- What conclusions have I reached?
- If I accept the outputs, what about the applications? If I put my thoughts into practice what consequences will I face?

The above questions show that one may need all of the basic thinking skills for some higher order thinking processes such as critical thinking or problem solving. Critical thinking skills can be listed as follows: sorting, pairing, hypothesizing, comparing and contrasting, clustering, cause-effect analysis, forecasting, determining patterns and exceptions, planning, synthesizing, classifying, rating, deducting, reasoning, collecting data, evidence and knowledge (Berber et al., 2007, pp. 16–23).

2.4 The Tendency and Dimensions of Critical Thinking

While curricula and syllabuses or instructional methods are thought to be the most important tools that affect the tendency of critical thinking, other factors such as age, education, academic field, academic success, socioeconomic level, attending social or scientific activities, parent education level and parent occupation might well be taken into consideration (Ay & Akgöl, 2008, pp. 66–67).

“The California Critical Thinking Disposition Inventory is used for surveying the dispositional aspects of critical thinking”. The inventory, which was in 1990 developed by Facione, was the outcome of Delphi Project by American Philosophical Association, has 6 dimensions and 51 items (Kökdemir, 2003, pp. 82). Here are these 6 dimensions or critical thinking dispositions: *Analytic, Open-minded, Inquisitiveness, Confident in reasoning, Truth-seeking, Systematic*. Kökdemir (2003, pp. 80–82) interpreted these dispositions in the following way:

- **Analyticity:** It is a process of evaluation, which has been derived from fact finding and the tendency of using objective evidence. This skill is for anticipating problems and being pro-active in solving them.
- **Open-mindedness:** It expresses that one may be tolerant of divergent opinions with sensitivity to his or her own biases and respects and values differing opinions.
- **Inquisitiveness:** It reflects one’s tendency of learning new things, having intellectual curiosity values and being well-informed.
- **Confident in reasoning:** One trusts his or her own reasoning processes and judgments and also others trust them.
- **Truth-seeking:** One is courageous in asking questions, being honest in pursuing inquiry even when it does not support one’s interests or pre-conceived opinions.
- **Systematicity:** It is a tendency of being organized, orderly, focused and diligent in inquiry.

3. A Research on Critical Thinking Tendencies and Factors that Affect Critical Thinking of Higher Education Students

3.1 Aim of the Research

This research aims to determine critical thinking tendencies and factors that affect critical thinking of higher education students. In the study, critical thinking tendencies of freshman and senior students were analyzed depending on demographic features, faculties and departments.

By the end of the current research, the results will inform the researchers on the contribution of the Turkish higher education system on the university students regarding critical thinking dispositions. The tendencies of critical thinking of freshman students will be compared to acquisitions of senior students throughout their undergraduate studies.

3.2 Sample

The population of the study, which has been selected by random sampling technique is the students of Uşak University. The sampling of the study are comprised of students majoring as freshman and senior students at *Economics and Administrative Sciences (Business Administration, Economics, Finance, Public Administration departments), Faculty of Education (Grade School teaching, Social Studies Teaching, Mathematics Teaching, Turkish Teaching, Science Education department), Faculty of Engineering (Textile, Mechanical, Chemical departments,) and the Faculty of Sciences (Letters, History, Maths, Geography departments)*. 1.293 people were randomly selected out of 9.892 in the survey. The data collected were evaluated by the SPSS 18.0

(Statistical Package for The Social Science) program. The ratio of the main body representation is 99% with the maximum acceptable margin of error rate 3.34% as the difference between main mass and sample volume. Of the 1400 questionnaires conducted, 92.3% were returned complete and evaluated.

3.3 Data Collection Tools

The data were collected through personal information forms to determine the demographic features of the students of Uşak University and The California Critical Thinking Disposition Inventory (CCTDI) to measure the critical thinking levels of the students.

This inventory which was developed in 1990 as the outcome of Delphi Project by American Philosophical Association has 7 Subclasses. The inventory uses an overall scoring system calculated as the mean of all those subclasses in order to determine the tendency of critical thinking (Facione, Facione, & Giancarlo, 1998). These subclasses or dimensions are Truth-seeking, Open-mindedness, Analyticity, Systematicity, Self-confidence, Inquisitiveness and Maturity.

CCTDI, unlike other inventories, has not been designed to measure a skill, but the tendency or the level of the critical thinking of an individual.

3.4 Findings and Results

Table 2. Reliability values of the entire inventory and the subclasses

Dimensions	Reliability Coefficient
Analyticity	0,73
Open-mindedness	0,62
Inquisitiveness	0,72
Self-confidence	0,74
Truth-seeking	0,61
Systematicity	0,62
Entire Inventory	0,81

The reliability of CCTDI was found at 81%, which means the inventory with its dimensions are accepted highly reliable.

Table 3. Male-Female distribution according to the faculties and years

Faculty	Male		Female		Total	
	N	%	N	%	N	%
Eco. Adm. Sci.	142	11,0	307	23,7	449	34,7
Education	115	8,9	269	20,8	384	29,7
Engineering	110	8,5	71	5,5	181	14,0
Science-Letters	118	9,1	161	12,5	279	21,6
Total	485	37,5	808	62,5	1.293	100
Year						
One	269	20,8	461	35,7	730	56,5
Four	216	16,7	347	26,8	563	43,5
Total	485	37,5	808	62,5	1.293	100

Of the students that took part in the survey are from Faculty of Economics and Administrative Sciences with 34.7; Education Faculty with 29.7%; Faculty of Sciences and Letters with 21.6 %; Faculty of Engineering with 14%. 37.5 % of the students are male and 62.5 % are female. Of the 1.293 students that took part in the survey, 56, 51% are freshman (37.5% male and 20.8% female) while 43.5% are senior (16.7% male and 26.8% female).

Table 4. Parent's education level

Faculty	Mother's Education Level													
	Illiterate		Primary School		Middle School		High School		Undergraduate		Graduate		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Eco. Adm.Sci.	40	3.1	295	22.8	43	3.3	62	4.8	9	0.7	0	0.0	449	34.7
Education	42	3.2	244	18.9	42	3.2	41	3.2	15	1.2	0	0.0	384	29.7
Engineering	12	0.9	85	6.6	24	1.9	37	2.9	22	1.7	1	0.1	181	14.0
Science-Letters	38	2.9	184	14.2	28	2.2	24	1.9	5	0.4	0	0.0	279	21.6
Total	132	10.2	808	62.5	137	10.6	164	12.7	51	3.9	1	0.1	1.293	100

Faculty	Father's Education Level													
	Illiterate		Primary School		Middle School		High School		Undergraduate		Graduate		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Eco. Adm.Sci.	6	0.5	196	15.2	79	6.1	108	8.4	57	4.4	3	0.2	449	34.7
Education	6	0.5	161	12.5	68	5.3	84	6.5	65	5.0	0	0.0	384	29.7
Engineering	4	0.3	62	4.8	22	1.7	54	4.2	39	3.0	0	0.0	181	14.0
Science-Letters	6	0.5	155	12.0	49	3.8	50	3.9	18	1.4	1	0.1	279	21.6
Total	22	1.7	574	44.4	218	16.9	296	22.9	179	13.8	4	0.3	1.293	100

From Table 4, of the mothers, 62.5% finished primary school, 10.6% middle school, 12.7% high school, 3.9% undergraduate, 0.1% graduate. 10.2% of the mothers do not have a formal educational background. As for fathers, 44.4% graduated from primary school, 22.9% high school, 16.9% middle school, 13.8% undergraduate, 0.3% graduate. 1.7% of the fathers do not have a formal educational background. Therefore, fathers' educational level can be said to be slightly higher than that of mothers'.

Table 5. Statistics concerning the residential area of the students' hometown

Faculty	Residential Area									
	Village		Town		County		Province		Total	
	N	%	N	%	N	%	N	%	N	%
Eco. Adm.Sci.	59	4.56	32	2.47	148	11.45	210	16.24	449	34.73
Education	70	5.41	21	1.62	136	10.52	157	12.14	384	29.70
Engineering	12	0.93	2	0.15	62	4.80	105	8.12	181	14.00
Science-Letters	61	4.72	15	1.16	87	6.73	116	8.97	279	21.58
Total	202	15.62	70	5.41	433	33.49	588	45.48	1.293	100

Table 5 shows that of the students, 45.48% are from urban areas, 33.49% are from counties, 15.62% are from villages and 5.41% are from towns. The students who come from the provinces according to their faculties are as follows: 16.24% from Faculty of Economics and Administrative Sciences, 12.14% from the Faculty of Education, 8.97% from Faculty of Sciences and Letters, 8, and 12% from Faculty of Engineering. The county is the second most populated administrative area and here are the distribution of the students who are from the counties by faculty: 11.45% from Faculty of Economics and Administrative Sciences, 10.52% from the Faculty of Education, 6.73% from Faculty of Sciences and Letters, 4.80% from Faculty of Engineering. The figures of the students who come from towns are as follows: 2.47% from Faculty of Economics and Administrative Sciences, 1.62% from the Faculty of Education, 1.16% from Faculty of Sciences and Letters, 0.15% from Faculty of Engineering. The students who come from the villages according to their faculties are as follows: 4.56% from Faculty of Economics and Administrative Sciences, 5.41% from the Faculty of Education, 4.72% from Faculty of Sciences and Letters, 0, 93% from Faculty of Engineering.

Table 6. Statistics concerning mothers' occupation

Faculty	Mother's Occupation							Total	
	Housewife	Worker	Officer	Retiree	Shopkeeper	Self Employed	Other		
Eco. Adm.Sci.	N	404	19	12	12	2	0	449	
	%	31.2	1.5	0.9	.9	0.2	0.0	0.0	34.7
Education	N	342	14	12	11	5	0	384	
	%	26.5	1.1	0.9	0.9	0.4	0.0	0.0	29.7
Engineering	N	141	8	14	15	0	1	181	
	%	10.9	.6	1.1	1.2	0.0	0.1	0.2	14.0
SciencesLetters	N	254	10	3	7	3	0	279	
	%	19.6	.8	0.2	0.5	0.2	0.0	0.2	21.6
Total	N	1141	51	41	45	10	1	4	1.293
	%	88.2	3.9	3.2	3.5	0.8	0.1	0.3	100

According to the figures in Table 6, some occupations of the mothers of the students are as follows: house wives (88.2%), workers (3.9%), retirees (3.5%), officers (3.2%). On the other hand, the percentages of the housewife mothers by faculty are Economics and Administrative Sciences (31.12%), Education (26.5%), Sciences and Letters (19.6%), Engineering (10.9%).

Table 7. Statistics concerning fathers' occupation

Faculty	Father's Occupation							Total	
	Unemployed	Worker	Officer	Retiree	Shopkeeper	Self Employed	Other		
Eco. Adm.Sci.	N	9	89	61	129	39	6	116	449
	%	0.70	6.88	4.72	9.98	3.02	0.46	8.97	34.73
Education	N	14	68	74	95	40	4	89	384
	%	1.08	5.26	5.72	7.35	3.09	0.31	6.88	29.70
Engineering	N	2	36	30	66	20	5	22	181
	%	0.15	2.78	2.32	5.10	1.55	0.39	1.70	14.00
SciencesLetters	N	14	69	22	77	25	14	58	279
	%	1.08	5.34	1.70	5.96	1.93	1.08	4.49	21.58
Total	N	39	262	187	367	124	29	285	1.293
	%	3.02	20.26	14.46	28.38	9.59	2.24	22.04	100

According to Table 7, the occupations of the fathers of the students who took part in the survey with percentages are as follows: retirees (28.38%), miscellaneous (22.04%), workers (20.26%), shopkeepers (9.59%), unemployed (3.02%) and self-employed (2.24%).

Table 8. Statistics concerning some variables and scores gained on CCTDI

Variables	N	X	Ss	t/F	p	Significant Difference	
Gender	Male	485	3.58	.36	7.52	.006	Female
	Female	808	3.63	.31			
	Total	1293	3.61	.33			
Faculty	Eco. Adm.Sci.	449	3.65	.34	4.84	.002	Eco. Adm.Sci.Education Eco. Adm.Sci. Engine.
	Education	384	3.59	.31			
	Engineering	181	3.55	.35			
	Science-Letters	279	3.60	.33			
	Total	1.293	3.61	.33			

According to Table 8 the mean score on CCTDI is $X=3.58$ for males and $X=3.63$ for females. Thus, there was a significant difference ($t_{(1293)}=7.52$, $p<.01$) in the mean scores between gender and critical thinking. In other words, female students seem to be better at critical thinking skills compared to male students.

Critical thinking skill of the students was analyzed to see whether there was a difference, according to the faculties that the students attend. The table shows that a significant difference ($F_{(3,1289)}=4.84$, $p<.01$) across the faculties was observed. That is to say, departments of the university showed significant differences on critical thinking skills of the students. According to the results of Tukey analysis, the students who attend the Faculty of Economics and Administrative Sciences ($X=3.65$), can be said to be better at critical thinking skills or are more able to use this skill compared to the Faculty of Education students ($X=3.59$) and the Faculty of Engineering students ($X=3.55$).

Table 9. NOVA analysis of the scores gained on CCTDI and the scores of the departments

Variables	N	X	Ss	F	p	Significant Difference
Business	109	3.61	.32			
Economics	110	3.67	.33			
Finance	116	3.61	.37			
Public Administration	114	3.72	.34			
Elementary School Teacher Education	80	3.61	.27			
Social Sciences Teacher Education	94	3.56	.30			
Turkish Language Teaching	92	3.65	.34			
Mathematics Teacher Education	60	3.54	.26			Economics-Mathematics
Science Teacher Education	58	3.57	.35	2.92	.000	Pub. Adm.-Mechanical
Textile	40	3.62	.33			Pub. Adm.-Mathematics
Mechanical	91	3.52	.37			Literature-Mathematics
Chemical	50	3.55	.30			
Literature	70	3.67	.33			
History	82	3.61	.34			
Mathematics	63	3.48	.26			
Geography	64	3.64	.36			
Total	1.293	3.61	.33			

When critical thinking skill was analyzed according to the departments of the university, a significant difference can be said to be observed by the departments. That is to say, significant difference resulted from the following department pairs: Economics-Mathematics, Public Administration-Mechanical, Public Administration-Mathematics, and Literature-Mathematics. Thus, Economics, Public Administration and Literature students' critical thinking skills can be said to be better than those of the students of Mathematics, and critical thinking skills of Public Administration students to be better than those of Mechanical department students.

Table 10. T-test results of the scores of CCTDI by years

Years	N	X	ss	T	p
One	730	3.64	.34	3.52	.000
Four	563	3.57	.32		
Total	1293	3.61	.33		

Table 10 shows critical thinking tendencies vary that depend on the years of the university students. The results of t-test show that a significant difference ($t_{(1293)}=3.52$, $p<.00$) was observed between freshman and senior students. Freshman or first year students ($X=3.64$) seem to be better at critical thinking tendencies than senior students.

Table 11. The results of the multiple-regression analysis of the tendencies of critical thinking

Variable	B	Standard Error _B	β	T	p	Dual R	Partial r
Constant	3.64	.14		25.14	.00		
Faculty	.35	.18	.89	1.91	.06	.00	.10
Department	-.03	.02	-.86	-1.86	.06	-.01	-.09
Gender	.09	.03	.14	2.71	.01	.15	.14
Year	-.11	.04	-.14	-2.65	.01	-.13	-.13
Mother's Education Level	-.04	.02	-.13	-2.01	.04	-.16	-.10
Father's Education Level	.00	.02	.01	.17	.87	-.08	.01
Mother's Occupation	.01	.02	.03	.58	.56	-.05	.03
Father's Occupation	.00	.01	-.02	-.48	.63	-.02	-.02
Residential Area (Hometown)	-.02	.02	-.05	-1.05	.29	-.07	-.05
Number Siblings	.02	.01	.09	1.79	.08	.10	.09
R=0.279	R ² =0.078						
F _(10,387) =3.276	p=0.000						

The results of the regression analysis that depend on certain variables such as faculty, department, gender, year, parents' education level, parents' occupation, residential area, and number of siblings for predicting the critical thinking tendency were given in Table 11.

When dual correlation and partial correlation were analyzed between predictor variables dependent variable, highest correlation was determined ($r=-0.16$) to be between mother's education level and the tendency of critical thinking; however, when other variables were checked the correlation between the two variables was calculated as $r=-0.10$. It was observed that there was a positive, but lower ($r=0.15$) relation between gender and the tendency of critical thinking. While the tendency of critical thinking shows negative and lower correlation ($r=-0.13$) with the variable "year", with the number of siblings it was positive but at low level correlation.

The variables such as faculty, department, gender, year, parents' education level, parents' occupation, residential area, and number of siblings with the scores of the tendencies of critical thinking display a significant but lower level relation ($R=0.279$, $R^2=0.078$, $p<.00$). The variables dealt with could explain 8% of the total variance in the tendency of critical thinking.

According to the standardized regression coefficient (β), relative importance configuration of the predictor variables on the tendencies of critical thinking are as follows: faculty, department, gender, mother's education level. Only gender, year, and mother's education level were a significant predictor on the tendency of critical thinking when the results of t-test concerning the significance of the regression coefficients were analyzed. Other variables did not have a significant effect.

Table 12. Differentiation between the subclasses (dimensions) of CCTDI and gender

Subclasses (Dimensions)	Gender	N	X	Ss	t/F	p	Significant Difference
Analyticity	Male	485	4.05	.51	-2.67	.008	Female
	Female	808	4.12	.42			
Open-mindedness	Male	485	3.59	.47	-4.62	.000	Female
	Female	808	3.70	.41			
Inquisitiveness	Male	485	3.73	.55	2.87	.004	Male
	Female	808	3.63	.56			
Self-confidence	Male	485	3.37	.62	-1.05	.294	-
	Female	808	3.40	.56			
Truth-seeking	Male	485	3.24	.60	-6.61	.000	Female
	Female	808	3.45	.49			
Systematicity	Male	485	3.56	.54	1.65	.099	-
	Female	808	3.51	.48			

When the sub variables of the inventory were taken into consideration, according to gender there was a significant difference for females on analyticity ($t_{(1293)}=-2.67$, $p<.01$), open-mindedness ($t_{(1293)}=-4.62$, $p<.01$),

and truth-seeking ($t_{(1293)}=-6.61, p<.01$); however, on inquisitiveness ($t_{(1293)}=2.87, p<.01$), a significant difference was found in males. On the other hand, on the dimensions of self-confidence ($t_{(1293)}=-1.05, p>.01$), and systematicity ($t_{(1293)}=1.65, p>.01$), there was no significant difference. Hence, female students were seen to be better than male students on the dimensions of analyticity, open-mindedness, and truth-seeking. Whereas, inquisitiveness was the only dimension that male students were better than female students.

Table 13. Differentiation between the subclasses (dimensions) of CCTDI and faculties

Subclass	Faculty	N	X	Ss	t/F	p	Significant Difference
Analyticity	Eco. Adm.Sci.	449	4.14	.46	5.00	.002	Eco. Adm.Sci.-Engineering
	Education	384	4.09	.43			
	Engineering	181	3.99	.50			
	Science-Letters	279	4.08	.44			
	Total	1293	4.09	.46			
Open-mindedness	Eco. Adm.Sci.	449	3.69	.43	6.74	.000	Eco. Adm.Sci.-Engineering Education-Engineering
	Education	384	3.70	.41			
	Engineering	181	3.54	.46			
	Science-Letters	279	3.63	.44			
	Total	1293	3.66	.44			
Inquisitiveness	Eco. Adm.Sci.	449	3.69	.56	1.99	.114	-
	Education	384	3.61	.55			
	Engineering	181	3.69	.56			
	Science-Letters	279	3.70	.55			
	Total	1293	3.67	.56			
Self-confidence	Eco. Adm.Sci.	449	3.43	.60	1.42	.235	-
	Education	384	3.35	.58			
	Engineering	181	3.42	.54			
	Science-Letters	279	3.37	.58			
	Total	1293	3.39	.58			
Truth-seeking	Eco. Adm.Sci.	449	3.44	.55	4.96	.002	Eco. Adm.Sci.-Education Eco. Adm.Sci.-Engine.
	Education	384	3.33	.51			
	Engineering	181	3.27	.57			
	Science-Letters	279	3.38	.56			
	Total	1293	3.37	.54			
Systematicity	Eco. Adm.Sci.	449	3.59	.54	4.21	.006	Eco. Adm.Sci.-Education
	Education	384	3.47	.48			
	Engineering	181	3.54	.48			
	Science-Letters	279	3.52	.49			
	Total	1293	3.53	.51			

On the dimensions of analyticity, open-mindedness, truth-seeking, and systematicity, Faculty of Economics and Administrative Sciences had significant difference compared to Faculty of Education and Faculty of Engineering. That is to say, on the dimensions of analyticity, open-mindedness, and systematicity Faculty of Economics and Administrative Sciences was better than Faculty of Engineering and also in the dimension of systematically better than Faculty of Education. On open-mindedness, Faculty of Education was better than Faculty of Engineering.

Table 14. The results of t-test of the subscale (dimension) scores of CCTDI by years

Dimensions	Years	N	X	Ss	t	p
Analyticity	One	310	4.10	.51	1.60	.111
	Four	88	4.00	.41		
	Total	310	3.64	.44		
Open-mindedness	One	88	3.48	.50	2.82	.005
	Four	310	3.72	.58		
	Total	88	3.65	.51		
Inquisitiveness	One	310	3.39	.56	1.00	.317
	Four	88	3.41	.57		
	Total	310	3.44	.54		
Self-confidence	One	88	3.19	.59	-.19	.848
	Four	310	3.54	.49		
	Total	88	3.47	.46		
Truth-seeking	One	310	4.10	.51	3.69	.000
	Four	88	4.00	.41		
	Total	310	3.64	.44		
Systematicity	One	88	3.48	.50	1.22	.224
	Four	310	3.72	.58		
	Total	88	3.65	.51		

A significant difference was found on open-mindedness and truth-seeking when the analysis was done for the variables of the year. The significant difference on open-mindedness ($t_{(1293)}=2.82$, $p<.05$) was in favor of senior students, while it was in truth-seeking ($t_{(1293)}=3.69$, $p<.00$) for freshman students. In other words, while senior students were better for open-mindedness, freshman students were better on truth-seeking dimension.

Table 15. ANOVA analysis of the scores gained on the subclasses (dimensions) of cctdi and the scores of the departments

Dimensions	Variables	N	X	ss	F	p	Significant Difference
Analyticity	Business	109	4.06	.44	4.24	.000	Eco.Adm.Sci-Mechanical Eco.Adm.Sci-Mathematics Finance-Mathematics Pub. Admn.-Mechanical Pub. Admn. -Chemical Pub. Admn. -Mathematics Elm Teach.-Mathematics Turkish-Mechanical Turkish-Mathematics Literature-Mathematics History-Mathematics Geography-Mathematics
	Economics	110	4.19	.45			
	Finance	116	4.09	.54			
	Public Administration	114	4.22	.41			
	Elementary School Teacher Education	80	4.10	.34			
	Social Sciences Teacher Education	94	4.08	.39			
	Turkish Language Teaching	92	4.18	.52			
	Mathematics Teacher Education	60	4.04	.36			
	Science Teacher Education	58	3.99	.49			
	Textile	40	4.14	.38			
	Mechanical	91	3.95	.57			
	Chemical	50	3.93	.43			
	Literature	70	4.17	.41			
	History	82	4.12	.45			
	Mathematics	63	3.84	.40			
	Geography	64	4.18	.41			
Total	1.293	4.09	.46				
Open-mindedness	Business	109	3.66	.43	3.67	.000	Turkish.-Finance Pub. Admn. -Mechanical Turkish.-Mathematics. Turkish.-Science Turkish.- Textile Turkish.- Mechanical Turkish.- Chemical Turkish.- Mathematics
	Economics	110	3.73	.45			
	Finance	116	3.61	.42			
	Public Administration	114	3.76	.42			
	Elementary School Teacher Education	80	3.73	.38			
	Social Sciences Teacher Education	94	3.66	.43			
	Turkish Language Teaching	92	3.86	.34			
	Mathematics Teacher Education	60	3.58	.41			

	Science Teacher Education	58	3.57	.46			
	Textile	40	3.56	.44			
	Mechanical	91	3.53	.51			
	Chemical	50	3.54	.38			
	Literature	70	3.65	.45			
	History	82	3.65	.46			
	Mathematics	63	3.54	.33			
	Geography	64	3.65	.50			
	Total	1.293	3.66	.44			
	Business	109	3.69	.53			
	Economics	110	3.70	.53			
	Finance	116	3.64	.60			
	Public Administration	114	3.75	.58			
	Elementary School Teacher Education	80	3.59	.54			
	Social Sciences Teacher Education	94	3.64	.58			
	Turkish Language Teaching	92	3.54	.58			
	Mathematics Teacher Education	60	3.63	.50			
Inquisitiveness	Science Teacher Education	58	3.68	.50	1.42	.131	-
	Textile	40	3.78	.57			
	Mechanical	91	3.69	.58			
	Chemical	50	3.62	.50			
	Literature	70	3.74	.54			
	History	82	3.75	.55			
	Mathematics	63	3.52	.47			
	Geography	64	3.76	.61			
	Total	1.293	3.67	.56			
	Business	109	3.37	.58			
	Economics	110	3.39	.56			
	Finance	116	3.45	.64			
	Public Administration	114	3.48	.60			
	Elementary School Teacher Education	80	3.35	.59			
	Social Sciences Teacher Education	94	3.28	.62			
	Turkish Language Teaching	92	3.39	.60			
	Mathematics Teacher Education	60	3.36	.48			
Self-Confidence	Science Teacher Education	58	3.39	.56	.89	.577	
	Textile	40	3.51	.65			
	Mechanical	91	3.36	.54			
	Chemical	50	3.46	.46			
	Literature	70	3.44	.62			
	History	82	3.41	.58			
	Mathematics	63	3.33	.42			
	Geography	64	3.31	.69			
	Total	1.293	3.39	.58			
	Business	109	3.39	.54			
	Economics	110	3.50	.52			
	Finance	116	3.38	.56			
	Public Administration	114	3.48	.55			
	Elementary School Teacher Education	80	3.39	.41			
	Social Sciences Teacher Education	94	3.24	.57	2.68	.000	Eco.Adm.Sci-Mechanical
	Turkish Language Teaching	92	3.42	.54			Literature-Mechanical
	Mathematics Teacher Education	60	3.25	.51			
	Science Teacher Education	58	3.34	.45			
	Textile	40	3.29	.63			
	Mechanical	91	3.23	.61			
	Chemical	50	3.33	.44			

	Literature	70	3.54	.52			
	History	82	3.29	.60			
	Mathematics	63	3.26	.45			
	Geography	64	3.44	.59			
	Total	1,293	3.37	.54			
	Business	109	3.55	.49			
	Economics	110	3.54	.52			
	Finance	116	3.55	.58			
	Public Administration	114	3.71	.54			
	Elementary School Teacher Education	80	3.45	.45			
	Social Sciences Teacher Education	94	3.43	.49			
	Turkish Language Teaching	92	3.55	.48			Pub. Admn. -Elm Teach.
	Mathematics Teacher Education	60	3.35	.44			Pub. Admn. -Social Sci
Systematicity	Science Teacher Education	58	3.54	.51	2.51	.001	Pub. Admn. -Mathematics.
	Textile	40	3.64	.53			Pub. Admn. - Geography
	Mechanical	91	3.47	.49			
	Chemical	50	3.61	.41			
	Literature	70	3.58	.51			
	History	82	3.57	.52			
	Mathematics	63	3.48	.45			
	Geography	64	3.42	.47			
	Total	1,293	3.53	.51			

A significant difference was found between the following department pairs on analyticity: Eco. Adm. Sci-Mechanical, Eco. Adm. Sci-Mathematics, Finance-Mathematics, Public Administration-Mechanical, Public Administration-Chemical, Public Administration-Mathematics, Elementary School Teaching-Mathematics, Turkish-Mechanical, Turkish-Mathematics, Literature-Mathematics, History-Mathematics, Geography-Mathematics.

On open-mindedness dimension, a significant difference was observed between these department pairs: Turkish-Finance, Public Administration-Mechanical, Turkish-Mathematics., Turkish-Science, Turkish-Textile, Turkish-Mechanical, Turkish-Chemical, Turkish-Mathematics.

On the dimension of truth-seeking a significant difference was found between the following department pairs: Eco.Adm.Sci-Mechanical, Literature-Mechanical.

On systematicity dimension, there was a significant difference between the following department pairs: Public Administration-Elementary School Teaching, Public Administration.-Social Sciences Teaching, Public Administration-Mathematics, Public Administration-Geography.

For inquisitiveness, no significant difference was found.

4. Conclusion

Today, it is so obvious that individuals have to survive in an information based economic society and interpersonal competitiveness require information based potential, critical thinking has been made known most important personal trait in order for the individuals- whether it is an employee or student-to become successful. Especially, individuals who have higher tendencies of critical thinking make significant differences in economics as well as social fields since they have superior thinking patterns.

Critical thinking, which require higher order cognitive skills, is a complex and comprehensive process that develops especially during higher education. Therefore, critical thinking characteristics in individuals develop through undergraduate education and appear as "asking questions, diagnosing the problem, evaluating the events, being tolerant against ambiguity by analyzing assumptions and biases".

In this study, the relationship between critical thinking tendencies and levels and the factors that affect the critical thinking tendencies of higher education students was determined. In the study, critical thinking tendencies of freshman and senior students were analyzed depending on demographic features, faculties and departments.

4.1 Results

The mean scores on CCTDI for males $X=3.58$ and females $X=3.63$ show that there is a significant difference ($t_{(1293)}=7.52, p<.01$). In other words, it could be considered that there is a positive relationship between gender and critical thinking. As a result, female students have been found more skilled than male students in terms of critical thinking abilities.

Also, a significant difference ($F_{(3,1289)}=4.84, p<.01$) was found among the faculties in terms of critical thinking. It was seen that the faculties that students attended made a positive difference in the critical thinking abilities. According to the results of Tukey analysis, it is clear that critical thinking abilities of the students from Economics and Administrative Sciences ($X=3.65$) have been better or they used the competence in a better way than those of the students of the Faculty of Education ($X=3.59$) and the Faculty of Engineering ($X=3.55$).

When critical thinking was analyzed at departmental level, a positive difference occurred between these department pairs: Economics and Administrative Sciences–Mathematics Teaching, Public Administration.-Mechanical Engineering, Public Administration-Mathematics Teaching, Literature-Mathematics Teaching. Thus, critical thinking skills of the students of Economics and Administrative Sciences, Public Administration and Literature were better than those of Mathematics Teaching while those of Public Administration were better than those of Mechanical Engineering.

There was found a significant difference ($t_{(1293)}=3.52, p<.00$) at the year level between year one or freshman students and year four or senior students according to the results of t-test. That is to say, critical thinking skills of the first year students ($X=3.64$) of Elementary School Teaching department were better than those of fourth year students.

Regression analysis results concerning the prediction of the tendency of critical thinking according to the variables of faculty, department, gender, year, education level of parents, occupation of parents, residential area, and number of siblings:

When dual and partial correlations between the predictor variable and dependent variable were analyzed, the highest correlation ($r=-0.16$) was between the mother's education level and the tendency of critical thinking; however, when checked with the other variables, the correlation was corrected as $r=-0.10$. There was a positive, but a low level ($r=0.15$) relationship between gender and critical thinking tendency. On the other hand, while there was a negative and low level ($r=-0.13$) correlation between critical thinking tendency and year variable, the correlation with the number of the siblings was positive but low level.

Among the variables of faculty, department, gender, year, education level of parents, occupation of parents, residential area, and number of siblings and the scores of the tendency of critical thinking there was a positive ($R=0.279, R^2=0.078, p<.00$) but low level relationship. The variables dealt with could explain 8% of the total variance in the tendency of critical thinking.

According to the standardized regression coefficient (β), the relative configuration of the importance of the predictor variables is as follows: faculty, department, gender, mother's education level. When the results of the t-test concerning the significance of the regression coefficients only gender, year, and the mother's education level were significant predictors on the tendency of critical thinking. Other variants had no important effects.

When the subclasses of the inventory were taken into account, according to the gender, on the dimensions of analyticity ($t_{(1293)}=-2.67, p<.01$), open-mindedness ($t_{(1293)}=-4.62, p<.01$), and truth-seeking ($t_{(1293)}=-6.61, p<.01$), there was a significant difference for females; in the dimension of inquisitiveness ($t_{(1293)}=2.87, p<.01$) was there a significant difference for males. There were not any significant differences in the dimensions of self-confidence ($t_{(1293)}=-1.05, p>.01$), and systematicity ($t_{(1293)}=1.65, p>.01$). That is to say, female students were better than male students in the dimensions of analyticity, open-mindedness, and truth-seeking; however, male students were better than female students in the dimension of inquisitiveness.

There was a significant difference for Economics and Administrative Sciences compared to the faculties of Engineering and Education in the dimensions of analyticity, open-mindedness, truth-seeking, and systematicity. In the dimensions of analyticity, open-mindedness, and systematicity, Economics and Administrative Sciences was better than the Faculty of Engineering. Moreover, Economics and Administrative Sciences was better than the faculty of Education in the dimension of systematicity. In the dimension of open-mindedness, the Faculty of Education was better than the Faculty of Engineering.

There was also a significant difference in the dimension of open-mindedness and truth-seeking between freshman and senior students. Senior students in open-mindedness ($t_{(1293)}=2.82, p<.05$) were better than

freshman students, and in truth-seeking dimension ($t_{(1293)} = 3.69, p < .00$) freshman students were better than senior students.

- **Analyticity dimension:** there were significant differences between the following department pairs: Economics and Administrative Sciences-Mechanical Engineering, Economics and Administrative Sciences –Mathematics Teaching, Finance–Mathematics Teaching, Public Administration-Mechanical Engineering, Public Administration–Chemical Engineering, Public Administration-Mathematics Teaching, Elementary School Teaching-Mathematics Teaching, Turkish Teaching-Mechanical Engineering, Turkish Teaching -Mathematics Teaching, Literature-Mathematics Teaching, History-Mathematics Teaching, Geography-Mathematics Teaching.
- **Open-mindedness dimension:** there were significant differences between the following department pairs: Turkish Teaching-Finance, Public Administration–Mechanical Engineering, Turkish Teaching–Mathematic Teaching, Turkish Teaching–Science Teaching, Turkish Teaching-Textile Engineering, Turkish Teaching–Mechanical Engineering, Turkish Teaching –Chemical Engineering, Turkish Teaching–Mathematics Teaching.
- **Truth-seeking dimension:** there were significant differences between the following two pairs: Economics and Administrative Sciences-Mechanical Engineering, Literature-Mechanical Engineering.
- **Systematicity dimension:** there were significant differences between the following department pairs: Public Administration.-Elementary School Teaching, Public Administration-Social Sciences Teaching, Public Administration-Mathematicseaching, Public Administration-Geography.
- No significant differences were found in the dimensions of inquisitiveness and self-confidence.

4.2 Suggestions

On critical thinking skills and tendencies, there are very few scientific researches conducted in Turkey. The effects of critical thinking on academic achievement in selection and placement exams such as YGS and LYS for Turkish universities should be researched. Beside the academic achievement, the effects of critical thinking skills on workplace achievement should also be sought. Also, the curricula of Turkish higher education should be reviewed to include either curricular or extracurricular activities concerning critical thinking skills since lacking the fundamental learning concepts such as thinking, analysis, synthesis and creativity might cause future employees to develop poorer job skills, which would jeopardize their employers in terms of productivity and innovation. For this reason, teaching methods should be reviewed to include such higher order cognitive skills for the university students.

The suggested strategies which may be utilized to enable the students acquire critical thinking skills are as follows:

- **Classroom evaluation techniques (CAT):** The aim of these techniques is to enable students to participate in classroom discussions using brainstorming activities. Today, some universities use active learning methods through some problem solving in order to make the students more participant and also help them develop critical thinking skills.
- **Cooperative/Collaborative Learning Strategies (CLS):** This activity requires more teacher control. The students are expected to discuss a given subject or make brainstorming activities.
- **Case Study/Discussion Method (CS/DM):** The students are expected to make inferences relating to the given case. Therefore, using different points of view the students will develop their critical thinking skills.
- **Developing Discussion Questions (DDQ):** The teacher asks the students certain questions at the end of the lesson which are discussed. Then the students produce follow up questions or new questions and ask them their peers or the teacher. This kind of instruction helps develop critical thinking skills.
- **Conference-style Learning (CSL):** This approach enables the students to foster their self-confidence since they take the stage to deliver their speeches. The students learn different points of views. In conference-style learning, the teacher is expected to become a facilitator as assigning readings and guiding discussion questions.
- **Essay Writing (EW):** Essays are a useful way of developing critical thinking since they give the students a chance for thinking; however, review or narrative essays do not have that much effect on the development of critical thinking skills as much as argumentative essays. The students should be encouraged to defend their arguments.

- **Pair Works (PW):** The students are expected to discuss on a given conversation. In fact, this technique is more like a thinking exercise for the students are expected to know about the characters in the dialogues to solve the problem or mystery. Therefore, the students have used their competence to develop their critical thinking skills.
- **Creating Ambiguity (CA):** With this technique, the students are expected to find a solution for a given ambiguous situation. They are strongly encouraged to think thoroughly.

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