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Teacher Candidates' Thinking Styles: An Investigation of Various Variables[1]

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Abstract

Within the scope of the research the following question has been addressed: "Is there a statistically significant difference in students' thinking styles according to (a) gender, (b) academic discipline and (c) grade, between the beginning and the end of an academic semester?" Purpose of the study is to reveal the differentiation occurred in teacher candidates' thinking style preferences during an academic semester, according to some variables. "Thinking Styles Inventory", developed by R. J Sternberg and R. K Wagner (1992), has been applied to 794 teacher candidates from various disciplines, at the beginning and end of the semester. As the result of the study, it has been found that, significant difference occurred in the "Conservative" sub-scale's mean scores between the 1st and 2nd application, for both genders. Regarding the means of "Conservative" sub-scale, it has been seen that the mean scores of female and male teacher candidates have increased at the end of the semester. Another finding of the study is that the joint effect of academic discipline and thinking style's differentiation status was significant for all sub-scales. Similar studies can be conducted with teacher candidates from different departments of education faculties. The current research was limited with one semester. On the other hand, longitudinal researches lasting an academic semester or more can be accomplished. Researches, covering other thinking styles and discovering the relationships among them can be conducted. Experimental studies featuring differentiation of the thinking styles are fairly limited. Therefore, experimental researches can be emphasized at teacher-training institutions. Thinking styles of teacher candidates are different form each other. Thus, the preparation of learning environment considering this diversity is an important step on teacher training. Individuals should organize and manage their own learning processes. Thus, raising teacher candidates' awareness about their own style seems to be crucial. Teacher candidates, after creating awareness about their own styles, can give the appropriate weight in activities for improving the style in order to achieve a task.

Keywords: teacher training, thinking styles, intellectual styles, individual differences

1. Introduction

In each era, education is a fact that is redefined according to the characteristics and requirements of the age via the studies featuring human nature. Therefore, the discovery of individual differences added new meanings to the education and to learning-teaching processes related with education. In the century we live, education area aims to create a difference not only in the behaviors of the individuals, but in their perceptions and thoughts as well; it supports learning environments that will reveal their unique potential; and release the individuals on configuring the path that they will choose while learning. These interpersonal differences affect an important area including the organization of learning environment, learning methods and the techniques and strategies that the teacher will use. In addition, individuals prefer different ways while learning, which reveals the diversity of the human mind and the distinctive structure of each brain. Therefore, the analysis of individual differences has aroused a great interest in the field of educational psychology (Cano-García, Hughes, 2000, 413). Thinking styles, defined as the path that an individual prefers on processing the information and dealing with the given task (Zhang, Sternberg, 2005, 2; Zhang, Sternberg, 2006, 3), is an important and promising working area.

A large number of research shows that there are differences among thinking styles according to many variables, such as

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gender, age, culture. However, does the way that people prefer while learning remain the same all the time? Style preferences differentiate from person to person while thinking; is it possible that an individual's thinking style preference may change over time? In fact, individuals don't have a single style; they have a profile formed by many styles. While performing a task, individuals either make the task compatible to their style or make their style compatible to the task (Fer, 2005, 464). It is very important for teacher candidates, who will be one of the crucial stakeholders of the education, to be aware of their thinking style preference and gaining the ability to use this preference in compliance with the task. Because, as the educational expectations change, the capabilities expected from the teachers, who are seen as the practitioners of education in the classroom environment, are also diversified according to the requirement of the age; their degrees of importance and priority vary. Consequently, different expectations arise in teacher education.

The review of the researches about teacher training, which were conducted using thinking style scale, shows that the focus was mostly on individual characteristics (gender, academic discipline, grade) and academic success and these variables were found to be correlated with thinking styles (Bernardo, Zhang and Callueng 2002, Buluş 2005, Fer 2005, Grigorenko and Sternberg 1997, Zhang 2000, 2001, 2004, 2006, 2010; Zhang & Sternberg 2000). In the current study, the differentiation of the thinking styles according to the mentioned individual characteristic, between the beginning and end of an academic semester has been investigated.

2. Methodology

Participants of the research, designed in descriptive pattern, were 794 teacher candidates who were studying at various department of Marmara University, Atatürk Faculty of Education, namely; Elementary Education, Science Education, Mathematics Education, Social Sciences Education, Foreign Language Teaching-English, Religious Culture and Moral Education, Fine Arts Education-Music. While selecting the departments, programs requiring different skills and proficiency have been preferred. Since the research was featuring individual differences, departments' possession of different structures, not similar ones, was crucial. The study has been conducted with 1st, 2nd and 3rd grades teacher candidates. The reason of not including 4th grade students, which were keen to graduation preparations, is the difficulty of reaching the same students for the second application. Table 1 shows the characteristics of the participants

Table 1. Characteristics of the Participants

		f	%
ACADEMIC DISCIPLINE	Elementary Education	210	26
	Science Education	73	9
	Mathematics Education	97	12
	Religious Culture Education	132	17
	Music Education	63	8
	Social Sciences Education	115	15
	English Language Teaching	104	13
	Overall	794	100
GENDER	Female	496	62
	Male	298	38
	Overall	794	100
GRADE	1st Grade	264	33
	2nd Grade	258	33
	3rd Grade	272	34
	Overall	794	100

The reason of including different number of participants from various disciplines was departments' capacities.

2.1 Instrument

Thinking Styles Inventory, which was used for the data collection of the research, has been developed by Sternberg and Wagner (1992). The scale consists of 5 factors and 13 sub-scales. Figure 1 shows these factors and sub-scales.

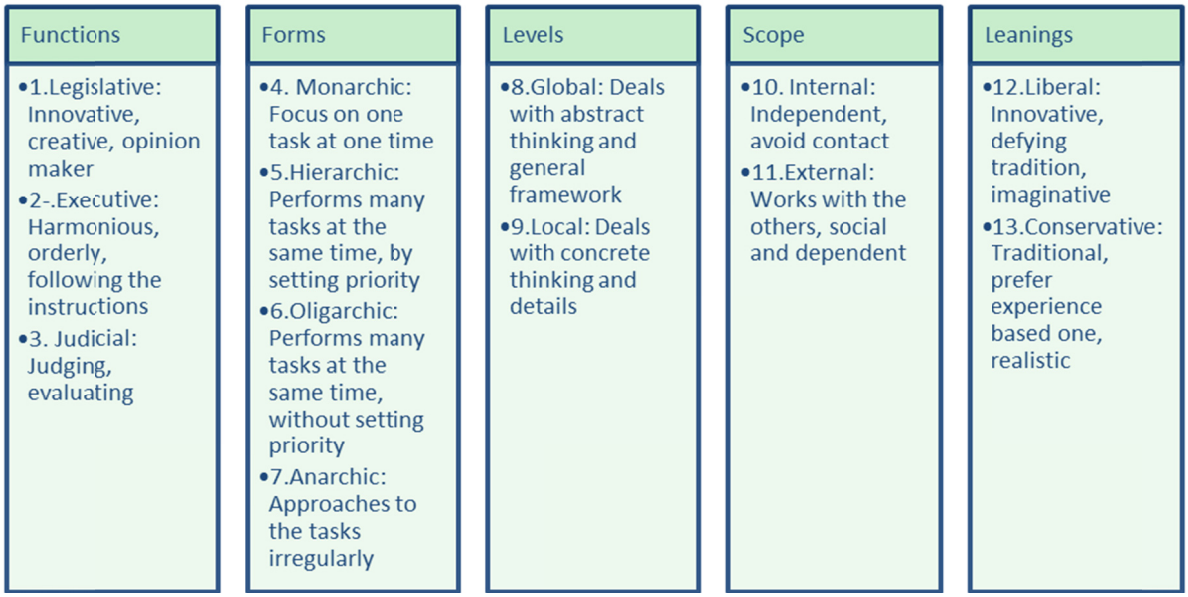

Figure 1. Thinking Styles Inventory's Factors and Sub-scales (Adapted from Zhang, 2001, 135- 551).

The original scale was composed by a total of 104 items, all expressed in positive sentence format. These items were structured to measure each thinking style with eight items - 13 subscales that were organized under five main dimensions. The evaluation was done using a 7 points Likert scale, where (1) not at all appropriate and (7) definitely appropriate. The scale aims to reveal the dominant styles among the 13 thinking styles, grouped under five main dimensions (factors). Since the dominant thinking style is measured independently for each main dimension, there is no overall score. Scores analyses were carried out on the basis of sub-scales; the score of each sub-scale was obtained by adding up the scores belonging to the sub-scale and dividing the sum to the number of items of the sub-scale.

Thinking Styles Inventory, has been adapted to Turkish several times by various researchers and its validity and reliability tests have been conducted (Sevinç and Palut 2001; Sünbül, 2004; Çubukçu, 2004; Fer, 2005; Buluş, 2005; Akbulut, 2006; Saracaloğlu, Yenice and Karasakaloğlu, 2008; Palut, 2003; Başol and Türkoğlu, 2009; Kaya, 2009). In this study, the version containing 70 items was used; its validity and reliability tests have been performed by Fer (2005). In order to examine the reliability of the scale, internal consistency analysis was carried out by evaluating Cronbach's Alpha values. Cronbach's Alpha reliability coefficient of the scale was found to be 0.95. Internal consistency of the scale was also high. As a result, it has been deducted that the scale was a tool that has internal consistency, making reliable measurements.

In addition to Thinking Styles Inventory, a personal information form, containing open-ended questions, has been used to collect information about participants' personal features (gender, academic discipline, grade).

2.2 Data Analysis

Data have been collected in two separate applications, one at the beginning (16.02.2011) and the other at end (08.04.2011) of 2010-2011 Academic years, spring fall, using "Thinking Styles Inventory". The applications have been conducted simultaneously, on a voluntary basis, after granting the permission of required academicians. Personal information form has been applied once, at the beginning of the semester, participants have used nicknames while filling it. Participants were asked to mark the same nicknames at the second phase. SPSS 16.0 program and ANOVA test have been used in data analysis.

3. Findings

The differentiations of the thinking styles according to three independent variables (gender, academic discipline and grade) at the beginning and end of the semester are displayed below.

Is There a Statistically Significant Difference in the Thinking Styles between the Beginning and End of the Semester, According to Gender?

The differentiations of the thinking styles between the beginning and end of the semester, according to gender can be seen in Table 2.

Table 2. Differentiations of the Thinking Styles between the Beginning and End of the Semester, According to Gender

SUB-SCALES	Source of Variance	Sum of squares	SD	Mean of squares	F	p
LEGISLATIVE	Between-subjects	10321,5	793			
	Gender	59,77	1	59,77	4,61	0,03*
	Error	10261,70	792	12,95		
	Within-subjects	7572,7	794			
	Measurement	190,24	1	190,24	20,42	0,00**
	Gender x Measurement	4,841	1	4,84	0,52	0,47
	Error	7377,61	792	9,31		
	Sum	17894,2	1587			
EXECUTIVE	Between-subjects	14725	793			
	Gender	208,26	1	208,26	11,36	0,00**
	Error	14516,76	792	18,32		
	Within-subjects	12133,5	794			
	Measurement	181,81	1	181,81	12,15	0,00**
	Gender x Measurement	104,98	1	104,98	7,01	0,00**
	Error	11846,70	792	14,95		
	Sum	26858,5	1587			
JUDICIAL	Between-subjects	49412,8	793			
	Gender	163,87	1	163,87	2,63	0,10
	Error	49248,96	792	62,18		
	Within-subjects	33111,3	794			
	Measurement	1236,81	1	1236,81	30,73	0,00**
	Gender x Measurement	4,255	1	4,25	0,10	0,74
	Error	31870,21	792	40,24		
	Sum	82524,1	1587			
HIERACHIC	Between-subjects	22196	793			
	Gender	540,37	1	540,37	19,76	0,00**
	Error	21655,64	792	27,34		
	Within-subjects	17400,9	794			
	Measurement	908,83	1	908,83	43,79	0,00**
	Gender x Measurement	56,991	1	56,99	2,74	0,09
	Error	16435,10	792	20,75		
	Sum	39596,9	1587			
MONARCHIC	Between-subjects	19807	793			
	Gender	94,17	1	94,17	3,78	0,05
	Error	19712,80	792	24,89		
	Within-subjects	13117,9	794			
	Measurement	319,93	1	319,93	19,84	0,00**
	Gender x Measurement	31,91	1	31,91	1,98	0,16
	Error	12766,08	792	16,11		
	Sum	32924,9	1587			
OLIGARCHIC	Between-subjects	37278,3	793			
	Gender	1016,90	1	1016,90	22,21	0,00**
	Error	36261,36	792	45,78		
	Within-subjects	31605,7	794			
	Measurement	5392,23	1	5392,23	163,86	0,00**
	Gender x Measurement	151,49	1	151,49	4,60	0,03*
	Error	26062,01	792	32,90		
	Sum	68884	1587			
ANARCHIC	Between-subjects	14595,3	793			
	Gender	206,93	1	206,93	11,39	0,00**
	Error	14388,32	792	18,16		
	Within-subjects	12209,3	794			
	Measurement	1592,10	1	1592,10	118,82	0,00**
	Gender x Measurement	5,506	1	5,50	0,41	0,52
	Error	10611,66	792	13,39		
	Sum	26804,6	1587			
GLOBAL	Between-subjects	41364,2	793			
	Gender	709,75	1	709,75	13,82	0,00**
	Error	40654,47	792	51,33		
	Within-subjects	28971	794			
	Measurement	460,50	1	460,50	12,96	0,00**
	Gender x Measurement	368,37	1	368,37	10,36	0,00**
	Error	28142,11	792	35,53		
	Sum	70335,2	1587			
LOCAL	Between-subjects	9846,19	793			
	Gender	23,21	1	23,21	1,87	0,17
	Error	9822,97	792	12,40		
	Within-subjects	9254,51	794			

	Measurement	15,23	1	15,23	1,30	0,25
	Gender x Measurement	19,55	1	19,55	1,67	0,19
	Error	9219,72	792	11,64		
	Sum	19100,7	1587			
INTERNAL	Between-subjects	48844,2	793			
	Gender	288,47	1	288,47	4,70	0,03*
	Error	48555,69	792	61,30		
	Within-subjects	40160,8	794			
	Measurement	3290,64	1	3290,64	70,74	0,00**
	Gender x Measurement	30,33	1	30,33	0,65	0,42
	Error	36839,83	792	46,51		
	Sum	89005	1587			
EXTERNAL	Between-subjects	40532,9	793			
	Gender	7,20	1	7,20	0,14	0,70
	Error	40525,69	792	51,16		
	Within-subjects	29904,5	794			
	Measurement	1532,27	1	1532,27	42,81	0,00**
	Gender x Measurement	30,61	1	30,61	0,85	0,35
	Error	28341,65	792	35,78		
	Sum	70437,4	1587			
LIBERAL	Between-subjects	51271,1	793			
	Gender	67,92	1	67,92	1,05	0,30
	Error	51203,19	792	64,65		
	Within-subjects	31799,2	794			
	Measurement	1044,66	1	1044,66	26,91	0,00**
	Gender x Measurement	13,70	1	13,70	0,35	0,55
	Error	30740,81	792	38,81		
	Sum	83070,3	1587			
CONSERVATIVE	Between-subjects	45854	793			
	Gender	513,67	1	513,67	8,97	0,00**
	Error	45340,28	792	57,24		
	Within-subjects	36752	794			
	Measurement	3662,20	1	3662,20	88,55	0,00**
	Gender x Measurement	334,86	1	334,86	8,09	0,00**
	Error	32754,96	792	41,35		
	Sum	82606	1587			

***p<0.01, *p<0.05,*

Significant differences have been observed between the 1st Application's and 2nd Application's mean scores of both gender groups in executive, oligarchic, global and conservative sub-scales. The review of the results, neglecting the gender, revealed that there are also significant differences between the 1st and 2nd Application's scores of the whole group. The joint effect of the factor, being in different groups (female/male) and measurements taken in different times (1st Application / 2nd Application) is significant.

Significant differences have been observed between the 1st Application's and 2nd Application's mean scores of both gender groups in legislative, judicial, hierarchic, anarchic and internal sub-scales; whereas there is no significant difference between the 1st Application's and 2nd Application's mean scores of both gender groups in monarchic, local, external and liberal sub-scales.

The joint effect of the factor, being in different groups (female/male) and measurements taken in different times (1st Application / 2nd Application) is not significant in legislative, judicial, hierarchic, anarchic, internal, monarchic, local, external and liberal sub-scales.

Is There a Statistically Significant Difference in Thinking Styles between the Beginning and End of the Semester, According to Academic Discipline?

The differentiations of the thinking styles between the beginning and end of the semester, according to academic discipline can be seen in Table 3.

Table 3. Differentiations of Thinking Styles between the Beginning and End of the Semester, According to Academic Discipline

SUBSCALES	Source of Variance	Sum of squares	SD	Mean of squares	F	p
LEGISLATIVE	Between-subjects	10321,5	793			
	Academic Discipline	138,01	6	23,00	1,77	0,10
	Error	10183,46	787	12,94		
	Within-subjects	7582,26	794			
	Measurement	199,80	1	199,80	22,01	0,00**
	Academic Discipline x Measurement	240,98	6	40,16	4,42	0,00**
	Error	7141,47	787	9,07		
	Sum	17903,8	1587			
EXECUTIVE	Between-subjects	14725	793			
	Academic Discipline	340,55	6	56,75	3,10	0,00**
	Error	14384,47	787	18,27		
	Within-subjects	12229,5	794			
	Measurement	277,79	1	277,79	19,13	0,00**
	Academic Discipline x Measurement	526,90	6	87,81	6,04	0,00**
	Error	11424,78	787	14,51		
	Sum	26954,5	1587			
JUDICIAL	Between-subjects	49412,8	793			
	Academic Discipline	1036,51	6	172,75	2,81	0,01*
	Error	48376,32	787	61,46		
	Within-subjects	33168,7	794			
	Measurement	1294,25	1	1294,25	33,27	0,00**
	Academic Discipline x Measurement	1263,15	6	210,52	5,41	0,00**
	Error	30611,31	787	38,89		
	Sum	82581,5	1587			
HIERACHIC	Between-subjects	22196	793			
	Academic Discipline	358,26	6	59,71	2,15	0,04*
	Error	21837,75	787	27,74		
	Within-subjects	17528,4	794			
	Measurement	1036,33	1	1036,33	52,56	0,00**
	Academic Discipline x Measurement	976,53	6	162,75	8,25	0,00**
	Error	15515,56	787	19,71		
	Sum	39724,4	1587			
MONARCHIC	Between-subjects	19807	793			
	Academic Discipline	421,42	6	70,23	2,85	0,00**
	Error	19385,55	787	24,63		
	Within-subjects	13186,1	794			
	Measurement	388,10	1	388,10	25,48	0,00**
	Academic Discipline x Measurement	813,27	6	135,54	8,90	0,00**
	Error	11984,72	787	15,22		
	Sum	32993,1	1587			

Table 4. Continued

SUBSCALES	Source of Variance	Sum of squares	SD	Mean of squares	F	p
OLIGARCHIC	Between-subjects	37278,3	793			
	Academic Discipline	3862,13	6	643,68	15,16	0,00**
	Error	33416,13	787	42,46		
	Within-subjects	30204,6	794			
	Measurement	3991,12	1	3991,12	125,37	0,00**
	Academic Discipline x Measurement	1160,44	6	193,40	6,07	0,00**
	Error	25053,06	787	31,83		
	Sum	67482,9	1587			
ANARCHIC	Between-subjects	34692,05	798			
	Academic Discipline	899,85	6	149,97	8,61	0,00**
	Error	33792,19	792	42,66		
	Within-subjects	11745,81	794			
	Measurement	1128,64	1	1128,64	87,67	0,00**
	Academic Discipline x Measurement	486,49	6	81,08	6,29	0,00**
	Error	10130,67	787	12,87		
	Sum	46437,86	1592			
GLOBAL	Between-subjects	41364,2	793			
	Academic Discipline	1745,49	6	290,91	5,77	0,00**
	Error	39618,72	787	50,34		
	Within-subjects	28873,4	794			
	Measurement	362,92	1	362,92	10,22	0,00**
	Academic Discipline x Measurement	579,08	6	96,51	2,71	0,01*
	Error	27931,41	787	35,49		
	Sum	70237,6	1587			
LOCAL	Between-subjects	9846,19	793			
	Academic Discipline	344,28	6	57,38	4,75	0,00**
	Error	9501,90	787	12,07		
	Within-subjects	9241,89	794			
	Measurement	2,61	1	2,61	0,23	0,62
	Academic Discipline x Measurement	595,12	6	99,18	9,03	0,00**
	Error	8644,14	787	10,98		
	Sum	19088,1	1587			
INTERNAL	Between-subjects	48844,2	793			
	Academic Discipline	1223,48	6	203,91	3,37	0,00**
	Error	47620,68	787	60,50		
	Within-subjects	40906,6	794			
	Measurement	4036,46	1	4036,46	96,03	0,00**
	Academic Discipline x Measurement	3789,75	6	631,62	15,02	0,00**
	Error	33080,41	787	42,03		
	Sum	89750,8	1587			
EXTERNAL	Between-subjects	40532,9	793			
	Academic Discipline	1850,62	6	308,43	6,27	0,00**
	Error	38682,27	787	49,15		
	Within-subjects	30098,8	794			
	Measurement	1726,55	1	1726,55	50,14	0,00**
	Academic Discipline x Measurement	1275,85	6	212,64	6,17	0,00**
	Error	27096,41	787	34,43		
	Sum	70631,7	1587			
LIBERAL	Between-subjects	51271,1	793			
	Academic Discipline	2515,28	6	419,21	6,76	0,00**
	Error	48755,84	787	61,95		
	Within-subjects	31775,3	794			
	Measurement	1020,76	1	1020,76	26,76	0,00**
	Academic Discipline x Measurement	742,68	6	123,78	3,24	0,00**
	Error	30011,83	787	38,13		
	Sum	51271,1	793			
CONSERVATIVE	Between-subjects	45854	793			
	Academic Discipline	2315,87	6	385,97	6,97	0,00**
	Error	43538,08	787	55,32		
	Within-subjects	36556,6	794			
	Measurement	3466,75	1	3466,75	84,73	0,00**
	Academic Discipline x Measurement	892,355	6	148,72	3,63	0,00**
	Error	32197,47	787	40,91		
	Sum	82410,6	1587			

***p<0.01, *p<0.05,*

As can be seen from Table 4, if the results are evaluated by neglecting academic disciplines, there are significant

differences between the 1st Application's and 2nd Application's mean scores of the whole group in all sub-scales. The joint effect of the factor, being in different process groups (Elementary Education / Science Education / Mathematics Education / Religious Culture Education / Music Education / Social Sciences Education / English Language Teaching) and measurements taken in different times (1st Application / 2nd Application) is significant in all sub-scales.

Is There a Statistically Significant Difference in Thinking Styles between the Beginning and End of the Semester, According to the Grade?

The differentiations of the thinking styles between the beginning and end of the semester, according to the grade can be seen in Table 5.

Table 5. Differentiations of Thinking Styles between the Beginning and End of the Semester, According to Grade

SUB-SCALES	Source of Variance	Sum of squares	SD	Mean of squares	F	p
LEGISLATIVE	Between-subjects	10321,5	793			
	Grade	26,84	2	13,42	1,03	0,35
	Error	10294,63	791	13,01		
	Within-subjects	7570	794			
	Measurement	187,54	1	187,54	20,13	0,00**
	Grade x Measurement	15,29	2	7,64	0,82	0,44
	Error	7367,16	791	9,31		
	Sum	17891,5	1587			
EXECUTIVE	Between-subjects	14725	793			
	Grade	9,110	2	4,55	0,24	0,78
	Error	14715,91	791	18,60		
	Within-subjects	12223,9	794			
	Measurement	272,17	1	272,17	18,02	0,00**
	Grade x Measurement	7,91	2	3,96	0,26	0,76
	Error	11943,77	791	15,10		
	Sum	26948,9	1587			
JUDICIAL	Between-subjects	49412,8	793			
	Grade	208,57	2	104,28	1,67	0,18
	Error	49204,26	791	62,20		
	Within-subjects	33143,3	794			
	Measurement	1268,83	1	1268,83	31,55	0,00**
	Grade x Measurement	69,86	2	34,93	0,86	0,42
	Error	31804,61	791	40,20		
	Sum	82556,1	1587			
SUB-SCALES	**Source of Variance**	**Sum of squares**	**SD**	**Mean of squares**	**F**	**p**
HIERACHIC	Between-subjects	22196	793			
	Grade	50,26	2	25,13	0,89	0,40
	Error	22145,76	791	27,99		
	Within-subjects	17579,1	794			
	Measurement	1087,04	1	1087,04	52,44	0,00**
	Grade x Measurement	98,15	2	49,07	2,36	0,09
	Error	16393,93	791	20,72		
	Sum	39775,1	1587			
MONARCHIC	Between-subjects	19807	793			
	Grade	10,69	2	5,35	0,21	0,80
	Error	19796,27	791	25,02		
	Within-subjects	13193,9	794			
	Measurement	395,90	1	395,90	24,48	0,00**
	Grade x Measurement	8,14	2	4,07	0,25	0,77
	Error	12789,85	791	16,16		
	Sum	33000,9	1587			
	Between-subjects	6230,05	1	6230,05	189,13	0,00**
	Grade	157,66	2	78,83	2,39	0,09
	Error	26055,84	791	32,94		
	Within-subjects	69721,9	1587			
OLIGARCHIC	Between-subjects	37278,3	793			
	Grade	333,41	2	166,70	3,56	0,02*
	Error	36944,85	791	46,70		
	Within-subjects	32443,6	794			
	Measurement	6230,05	1	6230,05	189,13	0,00**
	Grade x Measurement	157,66	2	78,83	2,39	0,09
	Error	26055,84	791	32,94		
	Sum	69721,9	1587			
ANARCHIC	Between-subjects	14595,3	793			
	Grade	7,82	2	3,91	0,21	0,80
	Error	14587,44	791	18,44		
	Within-subjects	12367,1	794			

	Between-subjects	1749,93	1	1749,93	131,14	0,00**
	Grade	62,20	2	31,10	2,33	0,09
	Error	10554,96	791	13,34		
	Within-subjects	26962,4	1587			
GLOBAL	Measurement	41364,2	793			
	Grade x Measurement	25,55	2	12,77	0,24	0,78
	Error	41338,67	791	52,26		
	Sum	29247,1	794			
	Between-subjects	736,63	1	736,63	20,51	0,00**
	Grade	102,57	2	51,28	1,42	0,24
	Error	28407,91	791	35,91		
	Within-subjects	70611,3	1587			
LOCAL	Between-subjects	9846,19	793			
	Grade	4,84	2	2,42	0,19	0,82
	Error	9841,34	791	12,44		
	Within-subjects	9266,6	794			
	Measurement	27,31	1	27,31	2,34	0,12
	Grade x Measurement	7,46	2	3,73	0,32	0,72
	Error	9231,81	791	11,67		
	Sum	19112,8	1587			
SUB-SCALES	**Source of Variance**	**Sum of squares**	**SD**	**Mean of squares**	**F**	**p**
INTERNAL	Between-subjects	48844,2	793			
	Grade	57,95	2	28,97	0,47	0,62
	Error	48786,21	791	61,67		
	Within-subjects	40216,8	794			
	Between-subjects	3346,60	1	3346,60	71,84	0,00**
	Grade	26,85	2	13,43	0,28	0,75
	Error	36843,30	791	46,57		
	Within-subjects	89061	1587			
EXTERNAL	Measurement	40532,9	793			
	Grade x Measurement	220,03	2	110,01	2,15	0,11
	Error	40312,86	791	50,96		
	Sum	29885	794			
	Between-subjects	1512,69	1	1512,69	42,33	0,00**
	Grade	107,35	2	53,67	1,50	0,22
	Error	28264,91	791	35,73		
	Within-subjects	70417,9	1587			
LIBERAL	Between-subjects	51271,1	793			
	Grade	135,22	2	67,61	1,04	0,35
	Error	51135,89	791	64,64		
	Within-subjects	31932,4	794			
	Measurement	1177,85	1	1177,85	30,29	0,00**
	Grade x Measurement	1,61	2	0,80	0,02	0,97
	Error	30752,90	791	38,87		
	Sum	83203,5	1587			
CONSERVATIVE	Between-subjects	45854	793			
	Grade	30,064	2	15,03	0,25	0,77
	Error	45823,90	791	57,93		
	Within-subjects	37576,4	794			
	Between-subjects	4486,59	1	4486,59	107,75	0,00**
	Grade	154,54	2	77,27	1,85	0,15
	Error	32935,28	791	41,63		
	Within-subjects	83430,4	1587			

***p<0.01, *p<0.05,*

As can be seen from Table 5, if the results are evaluated without considering grades, there are significant differences between the 1st Application's and 2nd Application's mean scores of the whole group in all sub-scales. The joint effect of the factor, being in different process groups (1st grade / 2nd grade / 3rd grade) and measurements taken in different times (1st Application / 2nd Application) is not significant in all sub-scales.

4. Conclusion

Based on the result of the study, thinking styles of teacher candidates have been differentiated according to gender during the academic semester in executive, oligarchic, global and conservative sub-scales; it has been seen that the joint effect of gender and differentiation status of thinking styles during the academic semester was also significant. However, the joint effect of gender and differentiation status of thinking styles during the academic semester was not significant in the other sub-scales. Regarding the sub-scale's means for female and male participants, it can be seen that the mean has been decreased between 1st and 2nd application in executive sub-scale, whereas it has been increased in global, oligarchic, and conservative sub-scales.

Another finding of the study is that the joint effect of academic discipline and differentiation status of thinking styles during the academic semester was also significant in all sub-scales. In hierarchic, monarchic, legislative, liberal, executive sub-scales, the means of teacher candidates from Science Education have been increased between 1st and 2nd application, whereas the means of remaining disciplines have been decreased. Regarding anarchic style, the mean of teacher candidates from Science Education has been decreased between 1st and 2nd application, whereas the means of remaining disciplines have been increased. In local sub-scale, the means of teacher candidates from science education, music education, social sciences education and English language teaching have been decreased whereas the means of elementary education, mathematics education, religious culture and morale education disciplines' teacher candidates have been increased. In global sub-scale, the means of teacher candidates from science education and English language teaching disciplines have been decreased whereas the means of teacher candidates from the other disciplines have been increased. Regarding external sub-scale, the mean of teacher candidates from elementary education has been increased, whereas the others have been decreased. In judicial style, the mean of teacher candidates from science education remained unchanged, whereas the others have been decreased. In internal sub-scale, the means of elementary education and science education disciplines have been increased, whereas the others have been decreased. Regarding oligarchic and conservative sub-scales, the mean scores of teacher candidates towards style preference have been increased in all academic disciplines.

Finally, it has been found that the joint effect of grade and differentiation status of thinking styles during the academic semester was not significant.

5. Discussion

In addition to Sternberg (1997) prediction in his Mental Self-management theory, suggesting the differentiation of thinking style preferences between females and males, Zhang and Sachs (1997) revealed that men were more holistic; Sternberg and Zhang (2005) found that males got higher scores than females in judicial sub-scale; Wu and Zhang (1999) reported that male students' liberal and monarchic style scores were higher than females; Cilliers and Sternberg (2001) found that female students preferred executive style more than males; Armstrong (2000) revealed that female students tended to think more local than males (Dinçer and Saracaloğlu, 2011). In the PhD thesis of Palut (2003), conducted with the participation of 558 teachers, it has been found that male teachers preferred to think more legislatively, globally and internally than women.

In the study conducted by Fer (2005), with the participation of 402 teacher candidates from Yıldız Technical University, English certificate program and Mathematics, Physics and Chemistry master degree programs (without thesis), it has been revealed that legislative and hierarchic styles were more dominant among female teacher candidates, whereas monarchic and conservative styles were more dominant among males. This finding about gender is in accordance with other studies (See, Grigorenko & Sternberg; Wu & Zhang, 1999) suggesting that thinking styles may vary according to gender (Fer 2005, 6). In other words, thinking styles differentiate according to gender. This result, which has been supported by the researches, is the reason of taking gender as a variable of this study. As a matter of fact, a significant difference has been observed in executive, oligarchic, global and conservative sub-dimensions of thinking styles.

In the research conducted by Buluş (2005) with the participation of 488 students (260 1st grade, and 228 4th grade) from various departments of Pamukkale University Education Faculty it has been found that; in overall, males were using global, internal and conservative thinking styles more than females; among 1st grade students, again males were using global, internal and conservative styles more whereas females were preferring executive style; among 4th grade students, males were using global, and judicial styles more (Buluş 2005, 16-17).

In the research conducted by Dinçer and Saracaloğlu (2011) with the participation of 1st and 4th grade students from Dokuz Eylul University, Buca Education Faculty, Primary School Department, Elementary Education, Mathematics, Social Sciences and English Language Teaching programs, during 2008-2009 academic years, it has been reported that there was a significant correlation between teacher candidates' preferred thinking styles and their gender. According to the study, this differentiation was in favor of male students in the preference of conservative and external styles. It has been seen that the scores of male students were higher than females in conservative and external sub-scales (Dinçer and

Saracaloğlu 2011, 723). These particular researches supported the predictions of Mental Self-management Theory and showed that thinking styles are not independent from the social environment. Although class level is seen as an important variable in terms of the differentiation of thinking styles, in this study thinking styles have not been differentiated according to class level.

One of the researches, featuring the differentiation of thinking styles according to academic discipline, has been conducted by Zhang and Sach (1997), in Hong Kong, with 88 participants. According to the results of the research, academic discipline is found to be one of the differentiating variables, such as gender; it has been found that participants studying natural sciences and technology got higher scores than participants studying social and human sciences in global sub-scale.

In the graduate study of Mert (2003), which has been approved by Hacettepe University, Social Sciences Institute, it has been revealed that academic discipline was effective on thinking styles. In the research conducted by Sünbül (2004) at Selçuk University, Education Faculty, with the participation of 268 students, it has been found that there were significant differences in monarchic thinking, hierarchic thinking, oligarchic thinking, anarchic thinking, internal thinking, liberal thinking and finally conservative thinking dimensions according to academic disciplines.

The results of the research conducted by Buluş (2005) were also similar to the other researches. According to the study, social sciences, science and physical education teacher candidates were using executive style more than teacher candidates of art education.

Fer, in his research conducted in 2005, reported that physics, chemistry and mathematics teacher candidates obtained higher execution scores than English language teacher candidates. Saracaloğlu, Yenice and Karasakaloğlu (2008) stated that elementary education teacher candidates got higher global thinking scores than science teacher candidates; Dinçer and Saracaloğlu, (2011) reported that teacher candidates' thinking styles have shown a significant difference only in executive thinking style and this difference was between English language and mathematics students, in favor of English language students.

In the study of Emir (2011) conducted on 275 senior students from Istanbul University, Hasan Ali Yücel Education Faculty, it has been revealed that there were differences in monarchic, oligarchic, anarchic, global, local, internal, external and conservative thinking styles of the scale according to academic disciplines. According to the study; there were significant differences in monarchic thinking style between Science Education, Social Sciences and Gifted Education departments in favor of the Social Sciences; moreover, there were significant differences in oligarchic thinking style between Mathematics and Science Education departments in favor of the Mathematics Education, as well as between Social Sciences and Science Education departments in favor of the Social Sciences Education. Therefore, the effect of academic disciplines on the differentiation of thinking styles has been taken into consideration and academic discipline was also accepted as a variable. Since all sub-dimensions of thinking styles have differentiated according to the discipline between the beginning and end of the semester, it can be said that the outcomes support the importance of the differentiation of thinking styles.

As can be seen from the researches, thinking styles were differentiating according to the disciplines, each requiring different capabilities. Similar to gender variable, this fact underlines the correlation between thinking styles and social environment.

Zhang and Sachs (1997) reported that, according to their research lower grades prefer monarchic and local styles more than upper grades. In the study conducted by Buluş (2005), it has been found that thinking styles were varied according to grades. Based on the research, significant differences have been revealed between the level of using legislative thinking style according to the grade of the students (1^{st} and 4^{th} grades). These findings showed that 4^{th} grade students were using legislative thinking style more than 1^{st} grade students; whereas they were using external thinking style less.

In another study of Buluş (2006), significant differences have been revealed in internal, external and conservative styles. In this study, 4^{th} grade students got higher scores in internal thinking style dimension, whereas they got lower scores in conservative thinking style dimension. In another study, statistically significant differences have been identified in internal thinking style across grades. It has been reported that 4^{th} grade students preferred internal thinking style more (Dinçer, 2009; Dinçer and Saracaloğlu, 2011).

As can be seen from the researches, teacher candidates' thinking style preferences were affected from many variables, such as gender, academic discipline, grade. This effect of social environment on thinking style supports the thesis that styles can be formatted. In other words, if social environment plays a role on determining the dominant style, it can be said that the dominant style may change with the change of this environment.

It has been seen that the results found in terms of gender and academic discipline were in accordance with similar researches. Moreover, unlike other researches, it has been observed that the effect of gender and academic discipline

variables were not restricted with the differentiation of thinking styles, at the same time they also affected the differentiation status of the thinking styles within the academic semester.

Similar studies can be conducted with teacher candidates from different departments of education faculties. The current research was limited with one semester. On the other hand, longitudinal researches lasting an academic semester or more can be accomplished. Researches, covering other thinking styles and discovering the relationships among them can be conducted. Experimental studies featuring differentiation of the thinking styles are fairly limited. Therefore, experimental researches can be emphasized at teacher-training institutions. Thinking styles of teacher candidates are different form each other. Thus, the preparation of learning environment considering this diversity is an important step on teacher training.

To improve the quality of learning, learning environment should be organized for students to learn more effectively (Özden, Kabapinar & Onder. Individuals should organize and manage their own learning processes. Thus, raising teacher candidates' awareness about their own style seems to be crucial. Teacher candidates, after creating awareness about their own styles, can give the appropriate weight in activities for improving the style in order to achieve a task.

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