

STRUCTURED ABSTRACT

What Are the Thinking Styles of Turkish Student Teachers?

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Background: The reason that the Thinking Styles Inventory, which was developed by Sternberg and Wagner based on Sternberg's (1988, 1997) earlier theory of mental self-government, was selected for the research to assess thinking styles of student teachers. Another reason is that, the theoretical constructs as well as the Inventory generated from the theory have proved to be valuable to assess thinking styles of people in several studies. For example, previous research reported that students differed in their thinking styles depending on their personal characteristics (e.g., Sternberg & Grigorenko, 1995; Zhang, 1999, 2002b, 2001e). However, research found no distinct patterns between thinking styles and personal characteristics of students (e.g., Grigorenko & Sternberg, 1997; Zhang, 2002a). Little research has been focused on the study of non-Western students' thinking styles. Thus, it is reasonable to expect that the thinking styles could also be identified among student teachers in Turkey since the styles are differentiated within a different country and culture.

Objectives of Study: (1) What is the validity and reliability of the TSI in assessing TS among Turkish student teachers? (2) Is the structure of a factor analysis of the TSI consistent with the five dimensions postulated by the theory of mental self-government in a Turkish sample? (3) Are TS of student teachers differentiated based on such socialization variables as gender, age, educational level, type of university attended, and field of study followed?

Research Design: The study reported here used quantitative methods with a survey sampling design.

Subjects: The research subjects were comprised of 402 student teachers who were enrolled in English, Mathematics, and Science Teaching Programs at Yildiz Technical University, Istanbul, Turkey.

Results: The results of factor analysis for construct validity of the inventory addressed 13 subscales under the five dimensional constructs with 104 items. Moreover, the total internal reliability of scale was .92 reliability coefficients. Findings demonstrated that the 13 subscales had internal consistency reliabilities; Cronbach's alphas of the 13 subscales for these subjects ranged from .61 to .91, as well as item-scale correlation that ranged from .37 to .88. Test-retest reliability for external reliability of subscales was between .63-.78. When the ANOVA findings of the research is evaluated as a whole, it might be said that the student teachers' particular thinking styles were differentiated by the socialized variables of gender, age, type of university attended, as well as field of study followed.

Conclusions/Recommendations: In order to measure thinking styles of students based on a model of broad intellectual styles; the inventory might be used as an efficient instrument. Moreover, the results of this study demonstrated a diversity of thinking styles among the participants. However, further research are needed to clarify the nature of thinking styles as assessed by the Inventory at different educational levels and culture to facilitate a better understanding of the thinking styles of students.

EXECUTIVE SUMMARY

What Are the Thinking Styles of Turkish Student Teachers?

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Introduction

The Thinking Styles Inventory was developed by Sternberg and Wagner (Sternberg, 1988, 1997), which is based on the earlier theory of mental self-government formulated by Sternberg (1988, 1997), representing stylistic aspects of intellectual functioning. The basic assumption of the theory is that people, like government and societies, have preferences in how they use their skills and how they govern their thought processes to manage their everyday activities; organize or govern themselves and their mental processes and establish systems and organizations for this governance. According to the theory, mental self-government is used to portray how the human mind works. Thus, there are different ways of managing people's mental activities, within the school and without. These different ways of managing people's activities are defined as thinking styles (Sternberg, 1988, 1994, 1997; Sternberg & Grigorenko, 1997). Styles are thought to be distinct from abilities, and to involve preferences, not necessarily conscious, in the use of whatever abilities one has. It is not connected solely with ability, but rather, a preferred way of expressing or using one or more abilities. (Armstrong, 2000; Cano-Garcia & Hughes, 2000; Grigorenko & Sternberg, 1997; Sternberg, 1997; Sternberg & Grigorenko, 1993, 1995, 1997; Sternberg & Lubart, 1991a, 1991b; Zhang, 2000; Zhang & Sternberg, 1998, 2000). The theory proposes 13 thinking styles under five dimensions of mental self-governance: functions, forms, levels, scope, and leanings.

The reason that the Thinking Styles Inventory was selected for the research was in order to assess thinking styles of student teachers. Another reason is that, the theoretical constructs as well as the Inventory generated from the theory have proved to be valuable in order to assess thinking styles of people in several studies. For example, research reported that students differed in their thinking styles depending on their personal characteristics (e.g., Sternberg & Grigorenko, 1995; Zhang, 1999, 2002b, 2001e). However, research found no distinct patterns between thinking styles and personal characteristics of students (e.g., Grigorenko & Sternberg, 1997; Zhang, 2002a).

In the theory of mental self-government, little research has been focused on the study of non-Western students' thinking styles. The non-Western studies using this theory were carried out in Hong Kong, mainland China, and the Philippines (e.g., Bernardo, Zhang, & Callueng, 2002; Zhang, 1999, 2000; Zhang & Sachs, 1997; Zhang & Sternberg, 2000). Thus, it is reasonable to expect that the thinking styles defined by Sternberg's theory could also be identified among student teachers in Turkey since thinking styles are differentiated within a different country and culture. That is why in the current study, the following research questions were addressed: (1) What is the validity and reliability of the TSI in assessing TS among Turkish student teachers? (2) Is the structure of a factor analysis of the TSI consistent with the five dimensions postulated by the theory of mental self-government in a Turkish sample? (3) Are TS of student teachers differentiated based on such socialization variables as gender, age, educational level, type of university attended, and field of study followed?

Methods

The research subjects were comprised of 402 student teachers who were enrolled in English, Mathematics, and Science Teaching Programs at Yildiz Technical University, Istanbul,

Turkey. All students entering these programs were selected as participants for this research. This sample of students was chosen as being convenient for the research objectives since these programs are open to individuals from different universities, fields, and backgrounds, which thinking styles of students from different backgrounds could be identified.

The Thinking Styles Inventory, which was developed by Sternberg and Wagner based on Sternberg's (1988, 1997) earlier theory of mental self-government, was used to examine the nature of thinking styles of student teachers. The inventory is designed to assess five dimensions of mental self-government: functions, forms, levels, scope, and leanings. Functions of thinking styles specify three subscales: legislative, executive, and judicial styles. Forms have four subscales: monarchic, hierarchic, oligarchic, and anarchic. Levels serve two subscales: global and local. A scope specifies two subscales: internal and external. Leanings of thinking styles have two subscales: conservative and liberal style. The inventory is a self-report test with 104 items, which contains 13 subscales, each of which has eight items. It is Data were collected from the student teachers by the researcher from five classes in the class session during the first week of the semester of the 2003-2004 academic year. Participation was on a voluntary basis in this research.

Results and Discussion

Findings demonstrated that the 13 subscales had internal consistency reliabilities; Cronbach's alphas of the 13 subscales for these subjects ranged from .61 to .91. Internal reliability on each scale had been also obtained via item-scale correlation. Findings also showed that the 13 subscales had internal consistency reliabilities ranging from .37 to .88. Test re-test reliability for external reliability of subscales was between .63-.78. An exploratory factor analysis with a varimax rotation method for construct validity of the inventory addressed 13 subscales under the five dimensional constructs with 104 items. Although the findings of the present study are somewhat inconclusive as to the nature and relationships of thinking styles among Turkish student teachers, the reliability and validity of the inventory obtained from the current study were considered sufficient for the purposes of this research.

In accordance with the third objective of this study, based on Sternberg's (1988, 1997) notion that styles are in part socialized, one-way analysis of variance procedures indicated that male students scored higher on the monarchic and conservative styles than did their female counterparts who scored higher on the legislative and hierarchic styles. Moreover, the younger students who were 19-23 and 24-28 years old scored significantly higher on the legislative and liberal styles than those who were 29 years old and the older, and thus it appears that female, as well as younger Turkish students have over time developed thinking processes that focus on trying out new and creative ways of thinking. This was expected, and in line with previous research that has shown that thinking styles could vary as a function of age and gender (e.g., Sternberg & Grigorenko, 1993, 1995; Zhang, 1999). Moreover, as Zhang (2002f) stated, gender and age differences might be attributed to the nature of psychological development of students.

There was also found that the participants who were pursuing graduate studies scored significantly higher on the executive style than the rest of the participants. Moreover, the less educated participants who were pursuing the fourth grade undergraduate studies and who had undergraduate degrees scored significantly higher on the liberal style than those who were on graduate studies programs. Similarly, the analysis showed that participants who were from the universities of Istanbul and Yildiz scored significantly higher on the executive style than those who were from other universities. Moreover, participants from Fatih University scored significantly higher on the hierarchic style than those who were from other universities. There was also a significant difference of study field on the executive style. The analysis indicated that student teachers who were from the Language, Science, and Mathematics fields of study

scored significantly higher on the executive style than those who were from other fields of study.

Generally speaking, the results of current research lent only partial support to Sternberg's (1988, 1997) notion that styles are in part socialized. Participants had significantly different particular thinking styles based on such socialization variables as gender, age, educational level, university type, and field of study pursued. Nevertheless, the importance of biological, psychological, sociological, and cognitive development, as well as individual differences can be emphasized. Therefore, these results need to be verified by future studies, especially those that pay attention to the effects of gender, university type, and field of study. In addition, although the one-way analysis procedures showed the statistically significant differences, effect size statistics, with a small effect, indicated that independent variables explained a small effect size on thinking styles of student teachers. Thus, the impact of the educational level, type of university attended, and field of study attended was not as large as it would be. Nevertheless, the findings of the present research strengthen and confirm the importance of a claim as well as a tendency of the thinking styles within the university concept. According to the theory of mental self-government (Sternberg, 1988, 1994, 1997), thinking styles are partially developed; moreover, culture is one of the foremost factors that shape thinking styles. Thus, different cultures and education systems might encourage or inhibit the development of specific styles. Styles are also thought, at least by some, to vary across context and specific tasks as well as in their developmental period, and to be partially socialized by the predominant culture (Sternberg, 1997). As Zhang (1999) says, if styles are partially socialized, then they are teachable.

Conclusions and Recommendations

The conclusions from the results of the present research might be of interest to educational psychologists, researchers, educators, and to the educational process. The first conclusion is that in order to measure thinking styles of students based on a model of broad intellectual styles; the inventory might be used as an efficient instrument. The second is concerning the relationship between thinking styles and socialization variables of student teachers. The results of this study demonstrated a diversity of thinking styles among the participants.

The results of this study also point to the direction for future research. Further research are needed to clarify the nature of thinking styles as assessed by the Thinking Styles Inventory at different educational levels and culture to facilitate a better understanding of the thinking styles of students. Further research is also needed to perform cross-cultural comparisons regarding the nature of thinking styles and clarify the socio-cultural developmental processes that shape how different thinking styles become interrelated.

What Are the Thinking Styles of Turkish Student Teachers?

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Abstract

The first objective of this study was to identify the validity and reliability of the Thinking Styles Inventory in assessing thinking styles among Turkish student teachers, within the framework of Sternberg's (1988, 1997) theory of mental self-government. The second was to investigate whether the structure of a factor analysis of the Thinking Styles Inventory was consistent with the five dimensions postulated by the theory of mental self-government in a Turkish sample. The third was to determine if thinking styles of student teachers were differentiated, based on such socialization variables as gender, age, educational level, type of university attended, as well as the field of study followed. The inventory was applied to the subjects of 402 student teachers. The results of factor analysis for construct validity of the inventory addressed 13 subscales under the five dimensional constructs with 104 items. The total internal reliability of scale was .92 reliability coefficients. Findings demonstrated that the 13 subscales had internal consistency reliabilities; Cronbach's alphas of the 13 subscales for these subjects ranged from .61 to .91, as well as item-scale correlation that ranged from .37 to .88. Test re-test reliability for external reliability of subscales was between .63-.78. When the ANOVA findings of the research is evaluated as a whole, it might be said that the student teachers' particular thinking styles were differentiated by the socialized variables of gender, age, type of university attended, and field of study attended.

Key Words: Thinking styles, validity and reliability, psychological counseling and guidance, teacher education and training.

Introduction

The concept of styles has been employed widely for many years in psychological and educational literature to identify individual differences in human performance. In this regard, an important current topic in research is the identification of different style constructs. There have been also various efforts to assess several dimensions of styles based on which constructs have been popular. For example, Sternberg and Grigorenko (1997) propose three general approaches to stylistic aspects of constructs in the style literature. According to them, the first approach is cognition-centered, which deals with individual differences in cognition and perception, resulting in the identification and description of several abilities and cognitive processing. Cognitive styles might be used to illustrate how one organizes certain information. Sample of cognitive styles are the field dependence-independence theory of Witkin, the wholist-analytic and the verbaliser-imager of Riding and Cheema. The second is personality-centered, which is associated with environmental and process-based issues related to addressing individual differences between people. Myers-Briggs type indicator is a sample of the personality style. The third approach is activity-centered, dealing with learning styles, which focuses on various activities, settings, and environments. This approach focuses on the activities that might arise from aspects of cognition and personality. Learning styles might be used to describe how one prefers to learn about certain information. Sample of activity styles are Kolb's experiential learning style and Grasha-Riechmann's student learning style. According to Dai and Feldhusen (1999), the theory of mental self-government concerns personality-functioning rather than merely cognitive preferences. On the contrary, Zhang (2002b, 2002f) states that the Thinking Styles Inventory is more cognition-oriented. Sternberg (1994) contended that thinking style is at the interface between intelligence and personality. In this study, the Thinking Styles Inventory is accepted and selected to be used in

the current research in a cognition-oriented sense since it refers to a particular and preferred way of thinking or cognition via its intellectual functioning.

The Thinking Styles Inventory was developed by Sternberg and Wagner (Sternberg, 1988, 1997), which is based on the earlier theory of mental self-government formulated by Sternberg (1988, 1997), representing stylistic aspects of intellectual functioning. The basic assumption of the theory is that people, like government and societies, have preferences in how they use their skills and how they govern their thought processes to manage their everyday activities; organize or govern themselves and their mental processes and establish systems and organizations for this governance. According to the theory, mental self-government is used to portray how the human mind works. Thus, there are different ways of managing people's mental activities, within the school and without. These different ways of managing people's activities are defined as thinking styles (Sternberg, 1988, 1994, 1997; Sternberg & Grigorenko, 1997). Styles are thought to be distinct from abilities, and to involve preferences, not necessarily conscious, in the use of whatever abilities one has. It is not connected solely with ability, but rather, a preferred way of expressing or using one or more abilities. (Armstrong, 2000; Cano-Garcia & Hughes, 2000; Grigorenko & Sternberg, 1997; Sternberg, 1997; Sternberg & Grigorenko, 1993, 1995, 1997; Sternberg & Lubart, 1991a, 1991b; Zhang, 2000; Zhang & Sternberg, 1998, 2000). The theory proposes 13 thinking styles under five dimensions of mental self-governance: functions, forms, levels, scope, and leanings. In Appendix A, a brief description of the key characteristics of each thinking styles described.

Functions of Mental Self-Government: As with the different functions of government, people also have three different functions for focusing on different tasks: legislative, executive, and judicial. A person with a legislative style likes being engaged in tasks with creating, imagining, and planning problem solutions and generating new approaches and solutions. An individual with an executive style is concerned with the proper implementation of tasks within a set of guidelines, following rules, figuring out known ways. A person with a judicial style is concerned with judging, analyzing, evaluating, and comparing the process and products of other people's activities.

Forms of Mental Self-Government: Just as there are different forms of government, individuals also have four different forms for focusing on different tasks: monarchic, hierarchic, oligarchic, and anarchic. People with a monarchic style deal with a single goal or way of doing one thing at a time, whereas people with a hierarchic style focus on many prioritized tasks, have a good sense of priorities, and tend to be systematic. People with an oligarchic style prefer to work on several tasks and multiple goals in the same time without setting any priority. Finally, people with an anarchic style enjoy dealing with tasks and situations, which are unstructured, often seem intolerant or unaware of the rules and regulations, and tend to resist authority.

Levels of Mental Self-Government: As in different levels of government such as, federal, state, county, and city, people also have two different levels for focusing on different tasks: global and local. An individual with a global style prefers to deal with problems general in nature and that require abstract thinking about the overall picture of an issue. On the contrary, a person with a local style prefers concrete problems, deals with specific aspects of an issue and specific details.

Scope of Mental Self-Government: Just as there are different scopes of government such as dealing both with internal, or domestic affairs, similarly, individuals also have two different scopes for focusing on different tasks: internal and external. An individual who is internal in style tends to be introverted, task-oriented, aloof, and work alone and independently. In contrast, a person with an external style prefers to deal with tasks that allow interaction with other people and to work with other people.

Leanings of Mental Self-Government: As with the ways government encompasses different political leanings ranging from the most conservative to the most liberal, people might lean in two different ways in order to focus on different tasks: conservative and liberal; referring to styles, not politics. A person with a conservative style likes to adhere to existing rules and procedures, minimizes change, and avoids ambiguous situations when possible. In contrast, an individual with a liberal style enjoys being engaged in tasks that involve novelty and ambiguity, and finding ambiguous and uncertain situations. (Bernardo, Zhang, & Callueng, 2002; Sternberg & Grigorenko, 1993; Sternberg, 1994, 1997; Zhang, 1999, 2001d).

Curry (1990) states that cognitive style is unchangeable. However, Allison and Hayes (1997; as cited in Hill, Puurula, Sitko-Lutek, & Rakowska, 2000) indicate cognitive style might be acquired through socialization. Moreover, Hill et al. (2000) state that the effects of cultural conditioning are agreed to be internalized through both family influences and the educational system. Similarly, thinking styles are modified, at least in part, to some degree, by the environment in which people live. Styles are also thought, at least by some, to vary across context and specific tasks as well as developmental period, and to be socialized by the predominant culture. People have a style profile, meaning they show varying amounts of each style, but they are not locked into any one profile. People choose styles of managing themselves with which they are comfortable (Grigorenko & Sternberg, 1997; Sternberg, 1988, 1994, 1997; Sternberg & Grigorenko, 1993, 1995, 1997). As Sternberg (1997) emphasizes, no single style is bad, and that the healthy classroom, or society, creates an environment in which all styles flourish. Nevertheless, he does not mean that everyone should adapt by developing the same and most socially accepted mode.

The reason that the Thinking Styles Inventory was selected for the current research was in order to assess thinking styles of student teachers. Another reason is that, the theoretical constructs as well as the inventory generated from the theory have proved to be valuable in order to assess thinking styles of people in several studies. For example, Grigorenko and Sternberg (1997) indicated that students' performance was associated with not only their levels and types of abilities, but also with their judicial, executive, and legislative thinking styles. Researchers also found in the U.S and Chinese samples that thinking styles statistically predicted academic achievement of students beyond abilities (e.g., Grigorenko & Sternberg, 1997; Zhang & Sternberg, 1998). According to Cano-Garcia and Hughes (2000), students who obtained the best results preferred to think and learn in a certain way, as well as the academic achievement of students being influenced by their thinking and learning styles. O'Hara and Sternberg (2000) revealed that people with a legislative thinking style showed higher creative performance, whereas people with a judicial thinking style indicated lower creative performance when not given any special instructions. Another study (see Sternberg 1994) indicated that most teachers were best at teaching children who matched their own styles of thinking and learning. Sternberg and Grigorenko (1993, 1995) found that teachers tended to overestimate the extent to which their students share their own styles, and that students in fact received higher grades and evaluations that were more favorable when their styles more closely matched those of their teachers. Sternberg (1994) found that teachers showed some differences in styles across subject-matter areas. For example, humanities teachers tended to be more liberal than science teachers were, and, science teachers tended to be more local than humanities teachers were. Sternberg (1994) clearly suggests that different types of assessment methods favor different types of thinkers.

However, previous findings have been mixed relating the effects of student characteristics such as age, gender, study field, and university class level on thinking styles. For example, Sternberg and Grigorenko (1995) found significant relationships between the teaching styles and the grade taught, the length of the teaching experience, and the subject area taught. Moreover, students differed in their thinking styles depending on their personal

characteristics, such as age, birth-order, and gender; and their learning environments. Zhang (1999) also revealed there were significant relationships between creativity-relevant styles and student characteristics of age, work experience, and travel experience. However, participants' thinking styles were not significantly different in terms of the following variables: birth order, college class level, field of study, marital status, gender, type of school attended, and parents' educational level. Furthermore, Zhang (2002b) reported that thinking styles of university students varied as a function of both their personal characteristics such as age, gender, and socio-economic status, as well as their situational characteristics, such as work, travel, and leadership experiences. In another study, Zhang (2001e) indicated that particular thinking styles were related to age, leadership experience, travel experience, and the number of hobbies undertaken. However, Grigorenko and Sternberg (1997) found no distinct patterns of particular thinking styles among gifted students of high school in terms of abilities, gender, or grade. Similarly, Zhang (2002a) reported no statistically significant difference between thinking styles and age, gender, and the previous work experience of university students.

In the theory of mental self-government, little research has been focused on the study of non-Western students' thinking styles. The non-Western studies using this theory were carried out in Hong Kong, mainland China, and the Philippines (e.g., Bernardo et al. 2002; Zhang, 1999, 2000; Zhang & Sachs, 1997; Zhang & Sternberg, 2000). Results of these studies are summarized briefly. First, students differ in their thinking styles. However, students' thinking styles vary depending on their personal characteristics. Second, reliability and validity of Thinking Styles Inventory has been demonstrated satisfactorily; and has shown a number of similarities across different cultures. Moreover, Sternberg (1997) suggests that thinking styles are common characteristics across culture, environments, and situations. Furthermore, he has contended that thinking styles are at least partially socialized. However, the results of these studies reported previously have been mixed concerning the effects of student characteristics on thinking styles. Thus, it is reasonable to expect that the thinking styles defined by Sternberg's theory could also be identified among student teachers in Turkey since thinking styles are differentiated within a different country and culture. That is why in the current study, the following research questions were addressed:

1. What is the validity and reliability of the Thinking Styles Inventory in assessing thinking styles among Turkish student teachers?
2. Is the structure of a factor analysis of the Thinking Styles Inventory consistent with the five dimensions postulated by the theory of mental self-government in a Turkish sample?
3. Are thinking styles of student teachers differentiated based on such socialization variables as gender, age, educational level, type of university attended, as well as the field of study followed?

Methods

Participants

The research subjects were comprised of 402 student teachers who were enrolled in English, Mathematics, and Science Teaching Programs at Yildiz Technical University, Istanbul, Turkey. All students entering these programs were selected as participants for this research. These students were chosen as being convenient for the research objectives since these programs are open to individuals from different universities, fields, and backgrounds, which thinking styles of students from different backgrounds could be identified.

The participants on this program came from two different kinds of academic backgrounds. Firstly, those who had pursued at least the last year of their undergraduate degree in a wide range of disciplines in which the language of instruction was English (English Teaching

Program). Secondly, those who were already enrolled on the Master of Education in Mathematics and Science Teaching Program in which a prerequisite of entry was possessing an undergraduate degree in Mathematics, Physics or Chemistry. Students earn dual degrees in their subject areas as a teacher for secondary schools; while they simultaneously obtain a master's degree status on completion of the teacher education program. This program, which lasts three semesters, each of which lasts 16 weeks, aims to prepare student teachers to teach their respective subjects at secondary school level. The program integrates a strong pedagogical knowledge and pedagogical content knowledge with a well-planned allocation of set hours in each semester for professional development.

Of the total number of participants, 43% (N=169) had completed a bachelor's degree, 32% (N=127) were pursuing the last year of their bachelor's degree (and intended upon graduation to proceed to the above-mentioned program, and 26% (N=102) were pursuing or already had a postgraduate degree. Among the participants, 64% (N=259) and 36% (N=143) were male and female respectively. The age of the participants ranged from 19 to 43 years, with 89% (N= 356) of them falling between 19 and 28 years.

The student teachers were from various universities including Istanbul (N=93, 24%), Bogazici (N=77, 19%), Yildiz Technical (N=75, 19%), Fatih (N= 74, 19%), and other (N=75, 19%) universities. The student teachers were also from various study fields such as Mathematics and Sciences (N=143, 36%), Languages (N=88, 22%), Business, Economy, and Administration (N= 71, 18%), Engineering and Architecture (N=42, 11%), Social Sciences (N=28, 7%) and other fields (N= 24, 6%). The universities and also the study fields of students which had less than 15 students were compounded as 'other' for the purpose of analyzing data for the present study.

Measures

The Thinking Styles Inventory, which was developed by Sternberg and Wagner based on Sternberg's (1988, 1997) earlier theory of mental self-government, was used to examine the nature of thinking styles of student teachers. In addition to the inventory, participants were asked to complete a subject information sheet to examine the relationships between the thinking styles and the student teachers' demographic characteristics such as gender, age, educational level, type of university attended, and field of study followed.

The inventory is a self-report test with 104 items, which contains 13 subscales, each of which has eight items. It is designed to assess five dimensions of mental self-government: functions, forms, levels, scope, and leanings. Participants were asked how well each item describes themselves and were asked to rate themselves on a seven-point Likert scale ranging from 1 to 7 (1 = not at all well, 7 = to extremely well) in order to assess one of the 13 thinking styles defined in the theory of mental self-government .

In the current study, the participants responded to a Turkish version of the inventory that was translated from English for this research. Reverse translation process between Turkish and English was carried out by three senior lectures of English who are specialists in English and Turkish language. In the reverse translation process, each statement was considered for within the consistency to the original inventory and its cultural accuracy of translation. Both The English and Turkish versions of the inventory were also applied to the 28 subjects similar to those of the participants of the present research to test the appropriateness between the Turkish and English versions of the inventory via test-retest. In terms of test-retest reliability, Pearson's correlations between two versions of the inventory ranging from .70 to .86 among the 13 subscales indicated acceptable reliability. The correlations were significant at the .01 and .05 level.

The reliability and validity of the Inventory has been demonstrated satisfactorily, and has shown a number of similarities across different cultures, in the sample of the USA, Spain,

Hong Kong, mainland China, and the Philippines (e.g., Bernardo et al. 2002; Cano-Garcia & Hughes, 2000; Dai & Feldhusen, 1999; Grigorenko & Sternberg, 1997; Sternberg, 1997; Sternberg & Grigorenko, 1993, 1997; Zhang, 1999, 2000; Zhang & Sachs, 1997; Zhang & Sternberg, 2000). In these studies, the inventory had internal consistency reliabilities; Cronbach's alphas of the 13 subscales ranged from .35 to .90. The results of factor analysis for construct validity of the inventory addressed 13 subscales under the three to five dimensional constructs. The factors yielded variance of the sample ranged from 35% to 78% in different cultures.

Procedure

Data were collected from the student teachers by the researcher from five classes in the class session during the first week of the semester of the 2003-2004 academic year. Participation was on a voluntary basis in this research. The student teachers were given the opportunity to clarify any question that they had about the administration of the inventory. The participants finished responding to the inventory in a total of 30 to 45 minutes. Four hundred two inventories returned from students were found to be usable for data analysis out of 441.

Results

Internal and External Reliabilities

Testing the first question of whether each subscale is measuring a single idea and whether the items that make up the subscale are internally consistent, internal reliability data have been obtained through both Cronbach's alpha coefficient and Pearson's correlations among the 13 subscales. Internal and external analysis is reported in Table 1.

Table 1

Internal and External Reliabilities for 13 Scales of the Thinking Styles Inventory

Subscales	N	X	SS	α	r1	r2
Legislative	390	5.65	.76	.81	.58-.74	.74
Executive	373	5.09	.96	.81	.55-.75	.72
Judicial	378	5.15	.88	.79	.48-.76	.74
Monarchic	378	4.57	.90	.61	.42-.64	.68
Hierarchic	381	5.46	.98	.88	.61-.80	.74
Oligarchic	370	3.97	.91	.68	.47-.68	.63
Anarchic	387	4.26	.96	.72	.41-.70	.75
Global	380	4.50	.97	.77	.48-.78	.75
Local	385	4.44	.90	.71	.40-.76	.71
Internal	385	4.49	1.07	.82	.54-.73	.73
External	378	4.85	1.02	.84	.37-.82	.78
Liberal	392	5.24	1.01	.91	.73-.84	.71
Conservative	385	3.68	1.18	.90	.49-.88	.72

α 1: Cronbach alpha of the subscales.

r1: Item-scale correlation of the subscales. Pearson's correlations were significant at the .01 level.

r2: Test re-tests reliability of the subscales. Pearson's correlations were significant at the .01 level.

Findings demonstrated that the total internal consistency reliability of the inventory for 13 subscales had an average Cronbach alpha coefficient of .92. The Cronbach's alphas of the 13 subscales for these subjects ranged from .61 to .91. Except for the measure of monarchic style, the internal consistency indicated reasonably high reliability. Internal reliability on each scale had been also obtained via item-scale correlation. Findings showed that the 13 subscales had internal consistency reliabilities ranging from .37 to .88. Pearson's correlations that were significant at the .01 level indicated acceptable internal reliability.

External reliability had been examined to test the degree of consistency of the measure over time via test re-test reliability in each subscale. For this aim, the inventory was applied by administering the same inventory on two occasions, over a period of 4 weeks, to the same group of 32 subjects who were similar to those of the participants for the present research. As can be seen in the Table 1, Pearson's correlations between two applications of the inventory ranging from .63 to .78 among the 13 subscales were significant at the .01 level, indicating acceptable external reliability.

Internal validity

Testing the first and second question, internal validity data had been obtained through both factor analysis and Pearson's correlations among the 13 subscales.

Scale Intercorrelations

Validity of the inventory was assessed to test the question of whether conceptually opposite styles tend to be negatively correlated; relevant pairs of correlations were compared by inter-scale correlations. The detailed result of analysis reported in Table 2.

Table 2
Interscale Pearson's Correlation Matrix for 13 Scales of the Thinking Styles Inventory

Subscales	1	2	3	4	5	6	7	8	9	10	11	12
Legislative												
Executive	.25**											
Judicial	.42**	.15*										
Monarchic	.15**	.43**	.08									
Hierarchic	.45**	.64**	.31**	.39**								
Oligarchic	.13*	-.02	.20**	.12*	-.12*							
Anarchic	.29**	.03	.30**	.12*	.04	.58**						
Global	.09	.37**	.13*	.58**	.32**	.11	.08					
Local	.33**	.07	.16**	-.03	.14*	.38**	.43**	-.26**				
Internal	.45**	.07	.18**	.18**	.14*	.33**	.36**	.17**	.25**			
External	.19**	.18**	.34**	.10	.30**	.24**	.27**	.11	.31**	-.16**		
Liberal	.45**	.03	.57**	.07	.24**	.24**	.34**	.04	.33**	.30**	.42**	
Conservative	-.06	.35**	-.18**	.41**	.12*	.17**	.11	.32**	.08	.06	.14*	-.28**

* Correlations were significant at the .05 level.

** Correlations were significant at the .01 level.

As illustrated in Table 2, intercorrelations for the 13 subscales were ranged from .02 to .64. Most of the scale intercorrelations were low. Essentially, some correlations were in the direction predicted by the theory of mental self-government. That is that global and local styles ($r = -.26$, $p < .01$), as well as liberal and conservative styles were negatively correlated ($r = -.28$, $p < .01$), as were internal and external styles ($r = -.16$, $p < .01$). However, there was a substantial overlap between legislative-executive ($r = .25$, $p < .01$) and legislative-liberal style ($r = .45$, $p < .01$), just as there was a correlation between executive and conservative styles ($r = .35$, $p < .01$). However, two of the significant correlations were in the direction that was not predicted by the theory of mental self-government, that is, the correlation between monarchic and hierarchic ($r = .45$, $p < .01$) and between judicial and hierarchic ($r = .31$, $p < .01$) styles.

Factor Analysis

An exploratory factor analysis was conducted to examine construct validity of the inventory. Visual inspection of eigenvalues with the scree test supported the possible extraction of five

factors in line with the theory of mental self-government. Therefore, a varimax rotation method was performed to determine the pattern of relationships of the subscales of the inventory. A five-factor solution also fitted the data of sample, when considering the Kaiser-Guttman criterion of eigenvalues exceeding 1. Five factors yielded and explained variance of the Turkish sample of 76 % in the data. The detailed result of analysis reported in Table 3.

Table 3.

Results of Factor Analysis for 13 Scales of the Thinking Styles Inventory

Subscales	1	2	3	4	5
Legislative	.19	.50	.51	-.07	.39
Executive	-.01	-.05	.79	.32	-.04
Judicial	.15	.79	.14	.12	-.06
Monarchic	.13	-.04	.37	.72	.06
Hierarchic	-.10	.27	.83	.19	-.01
Oligarchic	.83	.09	-.18	.16	.03
Anarchic	.78	.23	-.00	.07	.09
Global	.01	.08	.15	.88	.03
Local	.66	.08	.36	-.47	.01
Internal	.39	.18	.13	.12	.78
External	.38	.37	.29	.03	-.68
Liberal	.28	.81	.11	-.02	.00
Conservative	.37	-.57	.34	.39	-.14
Eigenvalues	3.63	2.36	1.63	1.25	1.05
% of variance	27.92	18.19	12.55	9.67	8.12
% of cumulative variance	27.92	46.11	58.67	68.34	76.47

As shown in Table 3, the results of factor analysis for the inventory addressed 13 subscales under the five dimensional constructs with 104 items. Factor one was dominated by the positive factor loadings of the oligarchic (.83), anarchic (.78), and local (.66) styles. Factor two showed the positive factor loadings for the legislative (.50), judicial (.79), and liberal (.81) styles as well as a negative loading for the conservative (-.57) style. Factor three was dominated by the positive loadings of the legislative (.51), executive (.79), and hierarchic (.83) styles. Factor four showed the positive factor loadings for the monarchic (.72) and global (.88) styles. Finally, factor five contrasted internal (.78) with external (-.68) style. Although there were cross-loadings by the legislative style, the five factors generally seemed relatively independent of one another.

Thinking Styles by Student Teacher Demographic Characteristics

Testing the third question, a one-way analysis of variance (ANOVA) was employed in order to identify the mean differences between thinking styles as the dependent variable and the student teacher socialized characteristics of gender, age, educational level, type of university attended, as well as the field of study followed as the independent variables. The Scheffe procedure was performed for post hoc comparisons. The mean results are reported in Table 4.

Answering how strong the effect of the different factors is, and their interaction, on the dependent variable requires calculating a measure of the effect size. Effect size is an indicator of how strong or how important research results are, which gives an understanding of the proportion of the variability in the dependent variables. While there are several different measures that exist for the computation of effect sizes within the *d* family (e.g., Cohen's *d*, Hedges's *g*), Cohen's *d*, the most common indicator employed, in the current research, Cohen's *d* is an effect size measure representing the standardized difference between two

means on some measured outcome. It should also be noted that Cohen (1988; cited in Thompson, 1994, 1996) gives very rough guidelines about estimating effect sizes that are categorized as small ($d = .20$), medium ($d = .50$), or large ($d = .80$). This guideline were adopted in this research to report the effect size of Cohen's d in terms of thinking styles and the student teacher characteristics of gender that has two group means.

As Thompson (1995, 1996) mentioned measures of effect size in ANOVA are measures of the degree of association between effect (e.g., a main effect, an interaction, a linear contrast) and the dependent variable. Four of the commonly used measures of effect size in ANOVA are: Eta squared (η^2), partial Eta squared (η_p^2), omega squared, and the Intraclass correlation. Omega squared and the intraclass correlations are estimates of the degree of association in the population. Both Eta squared and partial Eta squared are estimates of the degree of association for the sample, which are expressed as the proportion of the total variance in the dependent variable that is associated with a particular effect. Eta squared d that is the most common indicator was adopted for this analysis. Eta squared is computed as the sum-of-squares explained divided by the sum-of-squares total (Furr, 2004). SPSS for Windows as part of an ANOVA process gives Eta squared not the best measure of effect size, but is intuitively easy to understand. Eta squared varies from zero to one – the bigger the number the greater effect (just like a correlation coefficient). According to Cohen (1988; cited in Kotrlík & Williams, 2003), Eta squared effect sizes can be categorized as small ($\eta^2 = .01$), medium ($\eta^2 = .06$), or large ($\eta^2 = .14$), which has been adopted in this research to report Eta squared effect sizes. In the current research effect size of Eta squared reported in terms of between thinking styles and the student teacher characteristics of age, educational level, type of university attended, as well as the field of study followed, which have more than two groups. Cohen's d and Eta squared scores for each effect, for all the dependent variables in this study are shown in Table 4.

Table 4.
Means and Effect Sizes in Thinking Styles According to the Demographic Characteristics of Student Teachers

	leg	exec	judic	mon	hier	olig	anar	glob	loc	inter	exter	liber	cons
Gender													
Female	5.72	5.15	5.17	4.50	5.56	3.91	4.24	4.47	4.47	4.50	4.83	5.21	3.57
Male	5.52	5.01	5.12	4.71	5.29	4.08	4.31	4.57	4.39	4.48	4.91	5.32	3.88
Cohen's d	.26	.14	.06	-.23	.27	-.19	-.07	-.10	.09	.02	-.08	-.11	.26
Age													
19-23	5.58	5.14	5.09	4.53	5.40	3.92	4.20	4.45	4.39	4.39	4.82	5.06	3.74
24-28	5.83	4.98	5.26	4.62	5.57	4.06	4.32	4.50	4.59	4.69	4.94	5.54	3.60
29-33	5.59	5.43	5.47	4.79	5.73	4.03	4.39	4.88	4.33	4.48	4.94	5.47	3.58
34-48	5.67	5.19	4.86	4.35	5.33	3.74	4.68	5.01	4.41	4.33	5.05	5.36	3.71
Eta	.15	.11	.14	.08	.10	.08	.10	.14	.10	.13	.06	.22	.06
Eta ² (η^2)	.02	.01	.02	.00	.01	.00	.01	.02	.01	.01	.00	.05	.00
Educational Level													
Fourth Grade Underg.	5.57	4.86	5.23	4.57	5.30	3.90	4.16	4.33	4.36	4.41	4.77	5.01	3.55
Undergraduate Degree	5.71	5.17	5.19	4.61	5.52	4.03	4.40	4.61	4.56	4.61	4.95	5.37	3.82
Graduate Student	5.74	5.32	5.04	4.51	5.63	3.99	4.17	4.48	4.41	4.41	4.89	5.37	3.56
Graduate Degree	5.64	5.16	5.19	4.66	5.34	3.93	4.50	5.13	4.18	4.74	4.59	5.55	3.75
Eta	.09	.18	.08	.04	.13	.06	.12	.16	.11	.10	.08	.17	.10

Eta ² (η^2)	.00	.03	.00	.00	.01	.00	.01	.02	.01	.01	.00	.03	.01
University													
Bogazici	5.65	5.16	5.23	4.51	5.36	3.95	4.16	4.34	4.50	4.54	4.72	5.31	3.73
Istanbul	5.55	4.79	5.17	4.55	5.17	4.03	4.40	4.38	4.48	4.49	4.85	5.28	3.50
Yildiz	5.81	5.38	5.03	4.59	5.67	3.99	4.21	4.49	4.48	4.41	4.91	5.38	3.57
Fatih	5.73	5.24	5.16	4.76	5.72	3.98	4.12	4.72	4.35	4.59	5.02	5.14	3.88
Other	5.61	4.99	5.22	4.44	5.51	3.93	4.42	4.59	4.43	4.45	4.90	5.22	3.65
Eta	.12	.21	.08	.11	.21	.03	.12	.14	.05	.05	.09	.08	.11
Eta ² (η^2)	.01	.04	.00	.01	.04	.00	.01	.02	.00	.00	.00	.00	.01
Study Field													
Language Studies	5.60	4.80	5.15	4.51	5.32	3.98	4.24	4.28	4.39	4.49	4.68	5.07	3.48
Busin-Econ- Adm	5.69	4.98	5.37	4.43	5.55	3.91	4.18	4.64	4.29	4.63	4.88	5.38	3.49
Engin-Archit.	5.61	5.06	5.11	4.72	5.59	3.93	4.43	4.66	4.44	4.26	5.24	5.16	3.85
Social Studies	5.65	5.30	5.22	4.80	5.68	4.03	4.26	4.68	4.50	4.49	4.79	5.01	3.85
Science-Math	5.70	5.37	5.08	4.64	5.50	4.00	4.26	4.54	4.54	4.51	4.90	5.39	3.78
Other	5.77	4.85	5.19	4.30	5.18	4.02	4.40	4.30	4.59	4.57	4.82	5.23	3.81
Eta	.06	.24	.11	.14	.12	.04	.07	.15	.11	.08	.14	.14	.13
Eta ² (η^2)	.00	.06	.01	.02	.01	.00	.00	.02	.01	.00	.02	.02	.01

A one-way analysis procedure showed statistically significant difference of gender on the legislative and hierarchic styles. Female student teachers scored higher on legislative ($F(1, 388) = 5.98, p < .01$) and hierarchic styles ($F(1, 379) = 6.36, p < .01$) than did their male counterparts, the means being, respectively, 5.72 (SD 0.70), and 5.56 (SD 0.94). Furthermore, Cohen's d statistic effect size for these data yielded that gender accounted for .26 for legislative style and .27 for hierarchic style, with a moderate effect size, which means that approximately one quarter of the variance in each individual scores was explained by group differences. This analysis also indicated there was a statistically significant difference of gender on the monarchic and conservative styles. Male student teachers scored higher on monarchic ($F(1, 376) = 4.86, p < .02$) and conservative styles ($F(1, 383) = 5.91, p < .01$), than did their female counterparts, the means being, respectively, 4.71 (SD 0.96), 3.88 (SD 1.28). Furthermore, Cohen's d effect size revealed that student teachers' gender had a small effect size for monarchic ($d = -.23$), and for conservative style ($d = .26$), which means that 23% of the variability of the dependent variable of monarchic style and 26% of the variability of the dependent variable of conservative style can be explained in terms of the independent variable of gender. Thus, the impact of the gender variable was not as large as it would be.

An ANOVA showed that there was a statistical significance age difference on the legislative ($F(3, 381) = 3.27, p < .02$), judicial ($F(3, 369) = 2.54, p < .05$), global ($F(3, 371) = 2.56, p < .05$), and liberal ($F(3, 384) = 6.36, p < .00$) styles. This analysis showed that the younger students who were 19-23 and 24-28 years old scored significantly higher on the legislative and liberal styles than those who were 29 years old and the older. Eta squared statistic indicated that the ages of student teachers explained the small effect size estimate of legislative ($\eta^2 = .02$), judicial ($\eta^2 = .02$), global ($\eta^2 = .02$) and liberal ($\eta^2 = .05$) styles of student teachers. Note that the effect of thinking style is significant for all age groups, but is larger in magnitude for the youngsters than for the older.

Statistically significant differences of educational level were also found among the participants who were pursuing fourth grade undergraduate studies and who possessed bachelor's degrees superior to those who were in the graduate studies on the executive ($F(3,$

365) = 4.45, $p < .00$), global ($F(3, 373) = 3.28$, $p < .02$), and liberal ($F(3, 385) = 4.10$, $p < .00$) styles. This analysis indicated that the participants who were pursuing fourth grade undergraduate studies, as well as who had undergraduate degrees scored significantly higher on the liberal styles than those who were in the graduate studies. Moreover, the participants who were pursuing graduate studies scored significantly higher on the executive style than the rest of the participants. Furthermore, Eta squared for these data yielded an effect size estimate of executive ($\eta^2 = .03$), global ($\eta^2 = .02$), and liberal ($\eta^2 = .03$) styles of student teachers. What it has here is a small effect, even though it is statistically significant. Educational level does not seem to affect thinking style in an important way.

Similarly, there was a statistically significant difference among university attended on the executive ($F(4, 362) = 4.47$, $p < .00$) and hierarchic ($F(4, 371) = 4.38$, $p < .00$) styles. This analysis showed that participants who were from the universities of Istanbul and Yildiz scored significantly higher on the executive style than those who were from other universities. Moreover, participants who were from the University of Fatih scored significantly higher on the hierarchic style than those who were from other universities. Note that the effect of executive ($\eta^2 = .04$) and hierarchic ($\eta^2 = .04$) style is practically significant with small effect for student teachers.

There was also a statistically significant difference of type of study field attended on the executive ($F(5, 362) = 4.59$, $p < .00$) style. This analysis indicated that student teachers who were from the Language, Science, and Mathematics studies scored significantly higher on the executive style than those who were from other fields of studies. However, the sample estimate of Eta squared ($\eta^2 = .06$) was just .06, which means that the given field of study is estimated to account for 06% of variance in the dependent variable of executive style measure, with a medium effect size.

Discussion and Implications

In terms of the first objective of the current research, the total internal consistency reliability of the inventory for 13 subscales had an average Cronbach alpha coefficient of .92, higher than those reported in the previous research (e.g., Bernardo et al. 2002; Cano-Garcia & Hughes, 2000; Dai & Feldhusen, 1999; Grigorenko & Sternberg, 1997; Sternberg, 1997; Sternberg & Grigorenko, 1993, 1997; Zhang, 1999, 2000, 2001b, 2002a, 2002d; Zhang & Sternberg, 2000). The reason for the high reliability of the inventory might be explained by the relative heterogeneity of the Turkish sample in terms of the educational level, type of university attended, as well as field of study followed of the subjects. In keeping with the explanation of Tompson (1994) that “more heterogeneous samples often lead to more variable scores and thus to higher reliability. Therefore, the same measure, when administered to more heterogeneous or more homogeneous sets of subjects, will yield scores with differing reliability” (p.839). An alternative explanation for this result might also be found in the explanation for the Turkish sample. Other studies used a sample of college or secondary school students, while the present study investigated a sample of university students ranging from undergraduate to graduate degree, the high internal consistency of measures might offer up a function of sample differences. Except for the measure of monarchic style that were similar to those reported by Sternberg (1994; Alpha=.42), the Cronbach’s alphas of the scales for these subjects were reasonably high for the 13 subscales. Previously mentioned research employing the inventory obtained fairly encouraging reliability data, in general, ranging from .35 to .88 for the subscales. The internal and external reliabilities in each scale obtained from the current study were considered sufficient for this research.

In keeping with the first and second objectives of the study, some correlations were found in the direction predicted by the theory of mental self-government. Consistent with previous research (Sternberg, 1997), global and local styles, as well as liberal and conservative styles

were negatively correlated, as were internal and external styles. The results confirmed the previous finding (Sternberg, 1997), that there was a substantial overlap between legislative-executive and legislative-liberal styles, as was the correlation established between executive and conservative styles. These results are consistent with those obtained in the previous study conducted in Hong Kong (Zhang & Sachs, 1997). Inter-scale correlation analysis for the current research generally suggested that the 13 subscales are correlated in the directions that would be in keeping with those stipulated by the theory of mental self-government. However, some of the absolute values of the correlations were not as high as those reported in Sternberg's (1997) study were. Although the differences in correlations might arise as a result of problems connected to heterogeneity of sample, as previously noted, it might also be attributed to the fact that the subjects in the current research were tested in their second language. The low reliability of the measurement might be due to some problems in the translation of the items in the scale or to the lack of relevancy of some items used with Turkish students. Sample differences among cultures might also be the result of random fluctuations in the data. One possible explanation for these results might be found in the research of thinking styles, outlined in the introduction of the present study. Since the studies reported by Sternberg (1997) used a sample of college students, while the present study investigated a sample of university students ranging from undergraduate to graduate degree, the low correlations in the Turkish sample might be as a function of age, educational level, type of university attended, and field of study. On the other hand, the inventory might be less discriminative of different dimensions of stylistic difference among Turkish student teachers. Still, there are considerable similarities between the results reported in the different studies, as previously noted, covering samples from the USA, Europe, and Asia.

In terms of the first and second objectives of the study, an exploratory factor analysis with varimax rotation addressed 13 subscales under the five dimensional constructs, consistent with the theory of mental self-government. Although there were cross-loadings by the legislative style, the five factors generally seemed relatively independent of one another. Whereas the five-factor structure shares some features with previous findings, it differs in some ways. For example, Sternberg (1997) explained a five-factor model for 13 thinking styles conducted with the college student sample, partly supportive of the dimensions postulated by the theory. Research employing the inventory has obtained fairly encouraging construct validity of the inventory (e.g., Bernardo et al. 2002; Cano-Garcia & Hughes, 2000; Dai & Feldhusen, 1999; Grigorenko & Sternberg, 1997; Sternberg, 1997; Sternberg & Grigorenko, 1993, 1995, 1997; Zhang 1999, 2000, 2001a, 2001b, 2001c, 2001d, 2002a, 2002b, 2002c, 2002d, 2002e; Zhang & Sternberg, 2000). Including current study, the factor analysis of these studies generally partly have supported dimensions postulated by the theory since 13 subscales yielded under the three to five dimensional constructs and there seem cross-loadings by some of the dimensions. Nevertheless, generally speaking, although the findings of the present study are somewhat inconclusive as to the nature and relationships of thinking styles among Turkish student teachers, the reliability and validity of the inventory obtained from the current study were considered sufficient for the purposes of this research. This might be interpreted as an indication that the Thinking Styles Inventory is applicable in samples that differ culturally.

In accordance with the third objective of this study, based on Sternberg's (1988, 1997) notion that styles are in part socialized, one-way analysis of variance procedures indicated that male students scored higher on the monarchic and conservative styles than did their female counterparts who scored higher on the legislative and hierarchic styles. Moreover, the younger students who were 19-23 and 24-28 years old scored significantly higher on the legislative and liberal styles than those who were 29 years old and the older, and thus it appears that female, as well as younger Turkish students have over time developed thinking

processes that focus on trying out new and creative ways of thinking. This was expected, and in line with previous research that has shown that thinking styles could vary as a function of age and gender (e.g., Sternberg & Grigorenko, 1993, 1995; Zhang, 1999). It should also be noted that, as Zhang (2002f) states, gender and age differences might be attributed to the nature of psychological development of students.

An alternative explanation for gender differences might also be explained by the effects of culture. Sternberg (1997) indicates how different dimensions of culture might encourage or inhibit the development of specific thinking styles. Thus, individuals in one culture, compared with those in other cultures, might be expected to have a higher or lower preference for certain styles. In this connection, the findings of legislative and hierarchic style among female student teachers, and monarchic and conservative style among male student teachers, might reflect cultural preferences. Therefore, from the findings of the present study, it might be interpreted that different roles which are attributed to the members of each gender in Turkish society. As Tezcan (1995) indicated, while females are under social pressure, males are expected to preserve the traditional customs and values in Turkish society. In accordance with the findings from Tezcan (1993), females, on the contrary of the Turkish Law, in general, did not have equal rights in family life since until recently Turkish culture ascribed traditional roles to women. However, the changes in the educational system and improvement in the educational level, as well as the opening of new vocational opportunities have had an influence on the perceived role of women. Moreover, women are influenced in a positive way as a result of the changing nature of urbanization and secularism in the society in Turkey. In keeping with the opinions of Halonen and Santrock (1999), in recent years, the idea that parents are the critical agents in gender role development has come under fire. Culture, education, schools, press, the media, and family members also influence gender behavior. On the other hand, the world is extremely complex, and the use of stereotypes is one way we simplify this complexity. However, this is the first study that identified such a difference in thinking styles between female and male student teachers in Turkey. Therefore, this result can only be viewed as tentative.

There was also found that the participants who were pursuing graduate studies scored significantly higher on the executive style than the rest of the participants. Moreover, the less educated participants who were pursuing the fourth grade undergraduate studies and who had undergraduate degrees scored significantly higher on the liberal style than those who were on graduate studies programs. Similarly, the analysis showed that participants who were from the universities of Istanbul and Yildiz scored significantly higher on the executive style than those who were from other universities. Moreover, participants from Fatih University scored significantly higher on the hierarchic style than those who were from other universities. There was also a significant difference of study field on the executive style. The analysis indicated that student teachers who were from the Language, Science, and Mathematics fields of study scored significantly higher on the executive style than those who were from other fields of study. Although the difference might have resulted from Turkish sampling, as previously noted, it might also be attributed to the different educational system and culture. It is reasonable to assume that the cultural and educational concept and practices affect students. In accordance with the findings of the current study, it is possible to infer that Turkish educational system places a higher priority on the executive and hierarchical styles in terms of field of study attended and type of university attended. One possible explanation for these results might also be that the executive thinking style might correspond more to the nature of the courses studied in the fields of Language, Science, and Mathematics. Moreover, the form of thinking required might be associated with tasks particular to different types of the courses in the curriculum such as Language, Science, and Mathematics. An alternative explanation for these results might also be found in the way directives for students and teachers are issued

through the Turkish education system. For example, some aspects of the curricula applied in schools are organized in a very specific manner (Ministry of National Education, 1992, 1995, 1998, 1999). That is, the rate of compulsory courses in curricula is high but that of the elective courses is low. This situation restricts flexibility in the offering of the same opportunities in different areas of education. Subject mastery is more valued than pedagogical skills in education. Furthermore, teachers heavily rely on a didactic method of presentation in class, and appear to be traditionalist (OECD, 1989). Therefore, students of the executive style might get more encouragement to continue operating in the same tried and tested way than those of other styles. On the other hand, as Zhang (2002d) indicated, the executive style is related to analytic thinking for processing information. Most of the tasks in the executive style involve working on tasks for which clear guidelines, instructions, and structures. However, Zhang and Sachs (1997) have indicated that students in the fields of the Natural Sciences and Technology tended to be more globally orientated than those in the Social Sciences and Humanities tended to be. Another such study (Sternberg & Lubart, 1991a, 1991b) has revealed that students who were most creative come to generating new ideas in their research, regardless of their discipline.

Two points are worth discussing regarding the findings of thinking styles and type of the university. First, one possible explanation for these results might be found in the explanations of thinking styles, outlined in the introduction of the present study, as Sternberg (1997) noted, different cultures might value some thinking styles over others. Because each culture has its own values and each educational system has a different reward system, the particular thinking styles that might contribute to students are different for each culture. Even though there is not clear evidence in Turkish studies what the overriding reason might be, one of the possible explanations of the finding is that universities themselves might influence students' thinking styles since students from different universities are exposed to different learning and teaching environments. Each of cultures in these universities has unique characteristics that would help shape the thinking styles of university students. For example, Fatih University culture has been known for its values of ancestor worship and holding up collective effort as well as nontraditional assessments. Therefore, students from Fatih University tended to be more oriented to develop hierarchic thinking in an educational context. On the contrary, students from Yildiz and Istanbul universities are known for holding up individualism, the unity of ruling and teaching as well as traditional assessments. Therefore, students from Yildiz and Istanbul universities tended to be more oriented to develop executive thinking in an educational context. An alternative explanation is that, the results suggest that teachers at Fatih University put emphasis on the divergent abilities whereas teachers at Yildiz and Istanbul universities put great emphasis on convergent abilities. Moreover, as Zhang (1999) states, being in a tradition of quantitative assessment, students might be trying to meet the demands of the course requirements. For the same reason, high academic achievement tends to depend on convergent abilities to meet highly structured objectives rather than on divergent thinking abilities.

Previous findings have been mixed concerning the effects of student characteristics on thinking styles. For example, the significant differences in thinking styles on the basis of the aforementioned variables are consistent with previous studies (see Sternberg & Grigorenko, 1995; Zhang, 1999, 2001 b, 2002b; Zhang & Sachs, 1997), however, are inconsistent with previous research (Grigorenko & Sternberg, 1997; Zhang, 2002a). For example, Grigorenko and Sternberg (1997) found no distinct patterns of particular thinking styles among the high school gifted students by abilities, gender, or grade. Since the study reported used a sample of high school gifted students, while the present study investigated a sample of university students, the different findings in the Turkish sample might be seen as a function of age, educational level, type of university attended, as well as field of study followed. Similarly,

Zhang (2002a) reported no statistically significant difference between thinking styles and age, gender, and previous work experience of university students in Hong Kong. Although he used a sample of university students as the current research, the differences might have resulted from sampling. There is a growing interest and tendency that cultural ethnic values, social environment, and cognition are important factors for understanding differences in individual behavior (e.g., Schneider, 1989; Shaw, 1990). The development of thinking styles is also influenced by many variables and factors. For example, Zhang and Watkins (2001) found that cognitive-developmental patterns of the American and Chinese participants differed. However, no clear conclusion can so far be drawn based on the results of studies already conducted. Then, in this discussion, it was attempted to link the specific pattern of the results to Turkish cultural and educational concepts in particular since according to the theory of mental self-government (Sternberg, 1988, 1997), cultural factors might influence how thinking styles develop in a socio-cultural and educational context. Researchers have found within the Turkish educational system (e.g., Akdeniz, Yigit, & Kurt, 2002; Demirtas, 1999; Hasanoglu, 2003, Kucuk, Yesim, Saka, & Genel, 2002, Yanpar-Sahin, 2001; Yildirim & Demir, 2003) that there seems to be an emphasis in classroom instruction and learning, which tends to favor the teacher oriented approach. From a thinking style perspective, this approach helps develop the executive and conservative styles; on the contrary, the student oriented approach nurtures the legislative, global, and liberal styles (Sternberg, 1994, 1997; Sternberg & Grigorenko, 1995, 1997).

Because the education system stresses the executive and hierarchic thinking style, it is not surprising to find in the current study that thinking styles were differentiated as a function of the educational levels, university types, and study fields of participants. Moreover, in accordance with the opinion of Cano-Garcia and Hughes (2000), the fact of the matter is that because educational systems rewards through the awarding of 'good' grades, so students adapt their styles to the context as far as teaching methods, evaluation, etc are concerned. As a result, as is outlined by Sternberg (1997), a bias exists in education, which favors the development of specific styles of students, such as executive and hierarchic styles, as in current research. Yet even graduate students tend to be executive as shown in this study. However, results in the current study indicated that the female and younger student teachers used more effective thinking styles such as legislative and liberal styles that are associated with using creative strategies and complex information processing. In this sense, styles might be not innate but developed; and reflect task or situational demands, as well as individual dispositions (Sternberg, 1997; Sternberg & Grigorenko, 1997).

Generally speaking, in terms of the third objective, the results of current research lent only partial support to Sternberg's (1988, 1997) notion that styles are in part socialized. Participants had significantly different particular thinking styles based on such socialization variables as gender, age, educational level, university type, and field of study pursued. Nevertheless, the role of biological, psychological, and cognitive development, as well as individual differences might also encourage or inhibit the development of specific styles of students. Therefore, these results need to be verified by future studies, especially those that pay attention to the effects of gender, university type, and field of study. In addition, although the one-way analysis procedures showed the statistically significant differences, effect size statistics, with a small effect, indicated that each independent variable explained a small effect size estimates on thinking styles of student teachers. Thus, the impact of the educational level, type of university attended, and field of study attended was not as large as it would be. Still, the findings of the present research strengthen and confirm the importance of a claim as well as a tendency of the thinking styles within the university concept. According to the theory of mental self-government (Sternberg, 1988, 1994), thinking styles are partially developed and socialized; moreover, culture is one of the foremost factors that shape thinking styles. Thus,

different cultures and education systems might encourage or inhibit the development of specific styles. Styles are also thought, at least by some, to vary across context and specific tasks as well as in the developmental period of students, and to be partially socialized by the predominant culture (Sternberg, 1997). As Zhang (1999) says, if styles are partially socialized, then they are teachable.

Conclusions and Implications

It should be noted that there was a major limitation to the present study. That is, this is the first study that investigated thinking styles among Turkish students in Turkey. Therefore, the conclusion drawn regarding thinking styles should be considered preliminary. Further investigation is required to specify adequately thinking styles of students and their socialized variables that might be influenced their thinking styles.

Nevertheless, the conclusions from the results of the present research might be of interest to educational psychologists, researchers, educators, and to the educational process. The first conclusion is that in order to measure thinking styles of students based on a model of broad intellectual styles; the inventory might be used as an efficient instrument. These might open new perspectives in the field of learning and assessment, as much as in consultation processes. The second is concerning the relationship between thinking styles and socialization variables of student teachers. The results of this study demonstrated a diversity concerning particular thinking styles of student teachers.

What are the implications of these results? First, the diversity should be allowed in teaching and learning in and outside the classroom by giving the wide variation in students' thinking styles. As is outlined by Cano-Garcia and Hughes (2000), schooling should bring about the creation of learners who know how to learn. However, because educational systems rewards through the awarding of 'good' grades, so students adapt their styles to the context as far as teaching methods, evaluation, etc are concerned. As a result, as Sternberg (1997) has argued, a bias exists in education, which favors the development of specific styles of students. As Zhang (1999) has indicated, too many students tend to use executive and local thinking styles that will render them ineffective for future career survival. These executive and local student thinkers are not there by accident, but rather are a result of socialization. Being in an environment of quantitative assessment tradition, these students are merely trying to meet the demands of the course requirements. For the same reason, in higher education, high academic achievement tends to depend on convergent abilities to meet highly structured objectives rather than on divergent thinking abilities. As Cano-Garcia and Hughes (2000) have reported, executive and local styles can strengthen performance but do not much favor student learning or intellectual process from a cognitive viewpoint. According to cognitive theorists (see, Armstrong, 2000; Feldman, 2000; Halonen & Santrock, 1999; Morgan, 1997, Rayner & Riding, 1997; Sternberg & Williams, 2002), however, effective learning occurs via interaction with, and support from, people and objects in the world. Thinking is the manipulation of information perceived, learnt, and remembered. It is the mental creation of life. It is therefore necessary to access the styles used by students in learning and thinking, as well as to motivate educators to analyze their own teaching styles. As Sternberg (1997) says, teachers should design a way of teaching which takes into account the diversity of individual styles. This must be done to enrich and favor all the students. As stated by Zhang (2002c), educators should consider the fact that development of thinking styles of students in order to produce students who are going to be capable of adapting themselves to the ever-changing world, educators must cultivate creative thinking styles of students such as liberal and legislative styles. What can we do to change present situation? It has been argued by Sternberg (1997) that thinking styles are partially the result of socialization. If thinking styles are socialized, then they might be modified. As Zhang (2002c) says, in order to modify the thinking styles of students,

teachers might re-design their curricular activities by using multiple instructional and evaluation methods to allow for developing multiple thinking styles of students.

The results of this study also point to the direction for future research. Further research is needed to clarify the nature of thinking styles as assessed by the Thinking Styles Inventory at different educational levels and culture to facilitate a better understanding of the thinking styles of students. Further research is also needed to perform cross-cultural comparisons regarding the nature of thinking styles and clarify the socio-cultural developmental processes that shape how different thinking styles become interrelated.

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Appendix A. Thinking styles in the Theory of Self-Government

Thinking styles	Descriptions of thinking styles	Sample Item
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I. Functions		
Legislative	Working on tasks with creative strategies, own ideas and ways.	When working on a task, I like to start with my own ideas.
Executive	Working on tasks with guidelines and clear instructions.	I like projects that have a clear structure and a set plan and goal.
Judicial	Judging-evaluating process, products and performance of other people.	I enjoy work that involves analyzing, grading, or comparing things.
II. Forms		
Monarchic	Pursuing single task at a time.	When talking or writing about ideas, I stick to one main idea.
Hierarchic	Setting and deciding priorities to several tasks.	I like to set priorities for the things I need to do before I start doing them.
Oligarchic	Having multiple tasks without setting priorities.	I sometimes have trouble setting priorities for multiple things that I need to get done.
Anarchic	Taking random and flexible approach.	When discussing or writing down ideas, I use whatever comes to mind.
III. Levels		
Global	Dealing with the overall and general picture and abstract ideas.	I like situations or tasks in which I am not concerned with details.
Local	Dealing with details and concrete issues.	I like problems where I need to pay attention to detail.
IV. Scope		
10. Internal	Working on their own and alone.	I like projects that I can complete independently.
11. External	Working on tasks with other people.	When starting a task, I like to brainstorm ideas with friends or peers.
V. Learnings		
12. Liberal	Working on tasks with unfamiliarity, novelty and ambiguity.	I like to do things in new ways not used by others in the past.
13. Conservative	Doing tasks in traditional ways with the existing rules.	I like to do things in ways that have been used in the past.

Resource: (Grigorenko & Sternberg, 1997; Sternberg, 1994, 1997; Zhang, 2001d, 2002a).