

Relationship between Professional Values and Critical Thinking Disposition of Science-Technology and Mathematics Teachers

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The purpose of this study is to determine the relationship between the professional values and critical thinking disposition of science-technology and mathematics teachers working in middle schools. The survey research method was employed in the study. The sample of the study is comprised of 193 teachers (90 science-technology and 103 mathematics teachers) working in middle schools located in the city center of Afyonkarahisar, as well as the villages in the same province during the 2013-2014 academic school year. Teachers' Professional Values Scale (TPVS) and California Critical Thinking Disposition Inventory (CCTDI) were used as data gathering tools in the study. The data was analyzed through descriptive statistics, t-test, ANOVA and correlation analyses. The results of the study indicate that the level of teachers' having professional values is higher than middle level and their level of critical thinking disposition is low. Besides, there is a meaningful level of relation between teachers' professional values and critical thinking disposition.

Keywords: critical thinking, critical thinking disposition value, professional value

INTRODUCTION

Today, societies are known to face several social problems such as the threat of nuclear war, cybercrimes, cultural degeneration, fraud and corruption, identity crises, over-individualization, social alienation, lack of empathy, irresponsibility, and suicide or violence due to rapid and sudden changes in economic, political, social and cultural aspects. Educational institutions, in this regard, are influenced by the waves of these changes, yet they also function as organizations adapting themselves

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to scientific and technological developments and solving social problems having been created by globalization. At this point, the objective of education should be “to create an environment where teachers and students can efficiently question and discuss the relationship between theory and practice, critical analysis and common sense, learning and social transformation” (Giroux, 2009). For education to reach this objective, it is crucial to train individuals as a whole in mental, social, psychological, moral and emotional terms. Therefore, students should be equipped with values to develop their personalities as a whole, and to contribute to their social circles as well as themselves. In addition, students should be provided with the ways of thinking along with the logical, reasonable and consistent thinking habits.

Turkey, as in many other countries, has associated learning objectives regarding “values” and “critical thinking” with learning areas of various courses, and made them an integrated part of the curriculum following a redesign of all curricula in 2005. Hence, teaching both of the concepts has become compulsory by various subject matter teachers rather than a coincidental approach. In order for programs to be successful in terms of teaching these values, teachers need to possess, embrace, and practice certain values regarding the teaching profession. Once again, being responsible for training their students about critical thinking skills, teachers should primarily possess such skills themselves and be willing to demonstrate them. Now, is there a relationship between teachers’ possessing professional values and their critical thinking disposition? Does having a higher level of professional values equate to higher critical thinking disposition?

Values are defined as standards and beliefs, having an influence on and even shaping an individual’s behaviors, thoughts and decisions (Brand, 1999; Feather, 1975; Rokeach, 1973; Yılmaz, 2008) or as criteria determining the ideal means for thinking and behaving in society (Fichter, 1990). Work values, on the other hand, are related to beliefs and attitudes towards a profession and defined as criteria used by individuals to choose a targeted profession, beliefs and principles guiding individuals towards the ideal behavior in professional terms, qualifications indicating individuals’ professional preferences or needs, goals and outcomes of a profession (Avallone, Farnese, Pepe & Vecchione, 2010; Dose, 1997; Duffy & Sedlacek 2007; Krishnan, 2012; Li, Liu & Wan, 2008; Liu & Lei, 2012; Lyons, Higgins & Duxbury, 2010; Ros, Schwartz & Surkiss, 1999; Tunca, 2012; White, 2006). Although “work value” concept has a rather clear meaning, there is a gap in the literature in terms of the definition and classification of “professional values” that differ according to the nature of each profession, such as teaching or engineering (Ueda & Ohzono, 2012). Considering this gap, Tunca (2012) aimed at determining the values of the teaching profession on the basis of the literature with regard to “work values” and the “tasks, roles and responsibilities of the teaching profession” in

State of the literature

- One fundamental way of dealing with social issues is to raise individuals as a whole in moral and intellectual terms. Accordingly, today, the basic and common goal of different courses’ curricula is to equip individuals with “values” and “logical, rationalistic and coherent thinking habits”.
- The common function of professional values and critical thinking disposition is to guide and shape teachers’ education-related activities and professional decisions, as well as to influence the solutions that teachers are supposed to come up with for dealing with problems.
- In order for programs to be applied successfully in terms of teaching the values and the critical thinking skills, teachers need to possess professional values and critical thinking disposition.

Contribution of this paper to the literature

- Science-technology and mathematics teachers’ level of professional values is above moderate, while their critical thinking disposition is low.
- Teachers’ level of having professional values and critical thinking disposition significantly differs according to some individual variables.
- There are significant relationships between teachers’ professional values and their critical thinking disposition

her doctoral dissertation. In that research study, as a result of the data gathered from academicians, as well as in-service and pre-service teachers, the fundamental values of the teaching profession were defined as being “open to learn-change-innovations, being against discrimination, acting fairly, caring for human beings and students, being open-minded, being against violence, and being tolerant”. This study examines “being respectful to differences, individual and social responsibility, being against violence, and being open to cooperation” as professional values on the basis of the data gathering tool used (Tunca, 2012).

Critical thinking disposition is considered as complementary to critical thinking skills and habits. Such disposition triggers critical thinking, and hence motivates and encourages individuals to use critical thinking skills willingly and voluntarily (Facione, 1990, 1998; Facione, Sánchez, Facione & Gainen, 1995; Gündoğdu, 2009; Gürkaynak, Üstel & Gülgöz, 2008; Norris, 1985; Paul, Binker, Jensen & Kreklau, 1990; Paul, Binker & Weil, 1990). There are different classifications for critical thinking disposition in the literature. For instance, studies by the American Philosophical Association show that disposition of an individual with critical thinking skills are “continuous research, continuous questioning and reasoning, being open-minded, being unprejudiced, being fair in one’s judgments, being modest, having a clear perspective about issues, and being rational in selecting criteria” (Facione & Facione, 1996). Halpern (1996), on the other hand, states that critical thinking disposition consists of such attitudes as planned thinking and working, being open to new ideas and new ways of thinking, starting and completing a task by thinking through, rejecting unconditional acceptance of an idea, an approach or an ideology, and having a critical approach to one’s own thinking process (cited in Gürkaynak, Üstel & Gülgöz, 2008). In this research, critical thinking disposition which is dealt with based on the data gathering tool is analyticity, open-mindedness, inquisitiveness, self-confidence, truth-seeking, and systematicity (Kökdemir, 2003).

In the light of the theoretical explanations, it is expected to see a relationship between teachers’ professional values and their critical thinking disposition. A fundamental and common function of both variables is guiding teaching practices and professional decisions of teachers, as well as influencing potential solutions to problems encountered. It is indispensable for professional values, as influential criteria upon behaviors and decisions, to influence how one thinks; what one believes; how one makes sense of oneself, society or universe; one’s attitudes towards authority figures, external incentives, dogmatism and prejudices; and one’s questioning power. In consideration of the dimension of data gathering tools used in this study, it is natural for a teacher having a professional value such as “being respectful to differences” to have such critical thinking disposition as “open-mindedness” or “truth-seeking”. This research study is constructed to statistically test this theoretical relationship between “professional values” and “critical thinking disposition”. Considering the current literature, it wouldn’t be untrue to indicate that available researches have not yet reached generalizable results on whether values and critical thinking disposition differs in terms of personal variables like “gender, subject area, location of the school and seniority or not. One reason for that may be personal variables differ based on the scales used which focus on value types and sub dimensions and critical thinking disposition. In this regard, the present study also designed to analyze whether professional values and critical thinking disposition differ in terms of personal variables with the aim of contributing to the current literature with more generalizable results.

There are several studies in the literature which have determined teachers’ value preferences, or their attitudes towards values, using different data gathering tools (Aktepe & Yel, 2009; Aşkan, 2010; Dilmaç, Bozgeyikli & Çıkalı, 2008; Dilmaç, Ertekin

& Yazıcı, 2009; Dönmez & Cömert, 2007; Kuşdil & Kağıtçıbaşı, 2000; Memiş & Gedik, 2010; Oğuz, 2011; Sarı, 2005; Sezgin, 2006; Şahin-Fırat & Açıkgöz, 2012; Taşdan, 2008; Yazıcı, 2011; Yılmaz, 2011a). There are also major studies that have examined critical thinking disposition of pre-service teachers (Alper, 2010; Çubukcu, 2006; Emir, 2012; Şen, 2009; Türnüklü & Yeşildere, 2005; Yıldırım, Şensoy & Akçay, 2010; Zayıf, 2008). Besides, several studies have examined the relationship between several variables with both values (Bektaş & Nalçacı, 2012; Kubat & Kuruüzüm, 2010; Özdemir & Koruklu, 2011; Taşdan & Erdem, 2010; Yıldız & Dilmaç, 2012; Yılmaz, 2006, 2011) and critical thinking disposition (Alkın-Şahin, Tunca & Ulubey, 2013; Argon & Selvi, 2011; Arke, 2005; Beşoluk & Önder, 2010; Çokluk-Bökeoğlu & Yılmaz, 2005; Dutoğlu & Tuncel, 2008; Emir, 2013; Güven & Kürüm, 2008; Karasakaloğlu, Saracaloğlu & Yılmaz-Özelci, 2012; Kırmızı, Fenli & Kasap, 2014; Saracaloğlu & Yılmaz, 2011; Tortop & Eker, 2013; Torun, 2011; Tümkaya, 2011; Tümkaya, Aybek & Aldağ, 2009) through different data gathering tools. Nonetheless, no study has been found which has examined the relationship between teachers' professional values and their critical thinking disposition.

The purpose of this study is to determine the relationship between the professional values and critical thinking disposition of science-technology and mathematics teachers working in middle schools. Responses to the following questions have been sought to achieve this purpose:

1. What is the level of teachers' having professional values?
2. What is the level of teachers' critical thinking disposition?
3. Do teachers' levels of professional values and critical thinking disposition vary in terms of their gender, subject area, location of school and seniority?
4. Is there a relationship between teachers' professional values and critical thinking disposition?

METHOD

Model

The survey research method was employed in the study to describe the current and existing situation of the relationship between teachers' professional values and critical thinking disposition.

Sample

The population of the study is comprised of 285 teachers (130 science-technology and 155 mathematics teachers) working in middle schools located in the city center of Afyonkarahisar, as well as other outlying towns/villages in the same province during the 2013-2014 academic school year. The reason for conducting the study with science-technology and mathematics teachers is that (1) there is an established prejudice that teaching values and critical thinking disposition is relatively more difficult for teachers of natural sciences and mathematics; (2) as a reflection of this prejudice, both variables are examined in research studies mostly from the perspective of teachers of social sciences and languages; (3) nevertheless, science-technology and mathematics teachers have been officially responsible for teaching values and critical thinking as much as other teachers since the development of the 2005 elementary education curriculum. Disproportionate stratified sampling methodology was used to select the sample of the study. The sample size was calculated as 164 for 95% confidence level. It was decided to reach 200 teachers since there might be unworkable surveys in the study due to several reasons including lack of responses, invalid or incomplete responses. Analysis was conducted with 193 data gathering tools that were usable. Among the participant

teachers, 46.6% (n=90) are science-technology teachers, and 53.4% (n=103) are mathematics teachers. 64.2% (n=124) of the teachers work in middle schools located in the city center, and 35.8% (n=69) work in village schools. 49.7% (n=96) of the teachers are female, and 50.3% (n=97) are male. 1.6% of the teachers (n=3) have an associate degree, 89.6% (n=173) have an undergraduate degree, and 8.8% (n=17) have a graduate degree. Seniority varies from one year to 34 years, where 49.7% (n=96) have seniority less than 10 years, 34.7% (n=67) have between 10-19 years, and 15.5% (n=30) have 20 years or more service.

Data-gathering tools

Teachers' Professional Values Scale (TPVS) and California Critical Thinking Disposition Inventory (CCTDI) were used as data gathering tools in the study. PVS was developed by Tunca (2012), and includes 24 Likert-type questions to determine the professional values level of teachers. PVS consists of four main sub-dimensions, including being respectful to differences, individual and social responsibility, being against violence, and being open to cooperation. Items in this scale are scored from "1 - Does not reflect me at all" to "5 - Totally reflects me". Items under the 'being against violence' sub-dimension are reverse-scored. It is possible to obtain a total score from 24 to 120 from the overall scale. The higher the score obtained from the scale, the higher the level of having professional values is. Explanatory and confirmatory factor analyses were used in determining the construct validity of the scale. According to the results of the explanatory factor analysis, factor loading values of the scale were calculated as 0.54-0.72 for being respectful to differences, 0.49-0.65 for individual and social responsibility, 0.58-0.72 for being against violence, and 0.72-0.74 for being open to cooperation. Four sub-dimensions of the scale explain 46.57% of the total variance. Confirmatory factor analysis was held for the 24 items, under four sub-dimensions obtained upon the explanatory factor analysis. Statistical significance levels ($\chi^2/sd=2.29$) were then calculated via the confirmatory factor analysis for Chi-square value (χ^2) appropriate for the model established for the scale. The other goodness for fit indexes for the model (GFI=0.88, AGFI=0.86, RMSEA=0.06, SRMR, CFI, NFI and NNFI=0.92) also indicated that the model was appropriate. Reliability of the PVS was examined through Cronbach's Alpha coefficient, item-total correlations, comparison of extreme groups and test half-life technique. Cronbach's Alpha coefficient of the scale varied from 0.70 to 0.78 for sub-dimensions and 0.82 for the overall scale. This study re-tested the reliability of the scale, and found a Cronbach's Alpha coefficient from 0.61 to 0.76 for sub-dimensions and 0.77 for the overall scale.

California Critical Thinking Disposition Inventory (CCTDI) was adapted into Turkish by Kökdemir (2003). CCTDI consists of 51 Likert-type items to determine critical thinking disposition of teachers. CCTDI is comprised of six dimensions; namely analyticity, open-mindedness, inquisitiveness, self-confidence, truth-seeking, and systematicity. Items in the scale are scored from "1 - I strongly disagree" to "6 - I strongly agree". Twenty-two items in the scale are reverse-scored. The construct validity of the scale is ensured by explanatory factor analysis. The scale, in overall, explains a 36.13% of total variance with a Cronbach's Alpha of 0.88. This study re-tested the reliability of the scale, and found a Cronbach's Alpha coefficient of 0.81 for the overall scale. It is possible to obtain a total score from 51 to 306 from the overall scale. The higher the score obtained from the scale, the higher the critical thinking disposition level of teachers is. A total score below 240 ($\bar{x}=4.70$) from the overall CCTDI shows that the critical thinking disposition is "low", whereas a total score above 300 ($\bar{x}=5.88$) shows a "high" critical thinking disposition. In this study, analyses regarding the critical thinking disposition were conducted on the basis of total score.

Data Analysis

The study used descriptive analysis to determine the professional values and critical thinking disposition of teachers, t-test for dual comparisons, and one-way analysis of variance (ANOVA) for comparisons with three or more dimensions. For significant F values, Tukey test was used to determine the source of the difference. Pearson correlation analysis was used to determine the relationship between professional values and critical thinking disposition. An absolute value of correlation coefficient between 0.70-1.00 was interpreted as a high-level relationship, between 0.69-0.30 as a medium-level relationship, and 0.29-0.00 as a low-level of relationship (Büyüköztürk, 2005).

RESULTS

This section, in parallel with the aims of the study, primarily focuses on teachers' level of having professional values and their critical thinking disposition, and then deals with comparisons on the basis of gender, subject area, location of school and seniority, followed by the relationship between professional values and critical thinking disposition. Table 1 provides arithmetic mean and standard deviation of the level of ownership of professional values and critical thinking disposition of teachers.

According to Table 1, in view of the value ranges for CCTDI evaluation (Kökdemir, 2003), teachers' critical thinking disposition is low ($\bar{X}=4.05$, $S=0.48$). Teachers' ownership of professional values is above average ($\bar{X}=3.61$, $S=0.45$). Professional values owned by teachers are, respectively, "being respectful to differences" ($\bar{X}=3.98$, $S=0.68$), "being open to cooperation" ($\bar{X}=3.73$, $S=0.76$), "individual and social responsibility" ($\bar{X}=3.50$, $S=0.69$), and "being against violence" ($\bar{X}=3.12$, $S=0.80$). About being respectful to differences, the item with the highest agreement rate from teachers was "I defend the rights of students downtrodden at school due to their handicap" ($\bar{X}=4.26$, $S=1.02$), and with the lowest agreement was "I create a learning environment where all ideas are discussed and questioned" ($\bar{X}=3.54$, $S=1.18$). About being open to cooperation, the item with the highest agreement rate from teachers was "I conduct joint activities with parents to support their children's learning" ($\bar{X}=3.90$, $S=0.96$), and with the lowest agreement was "I determine strategies in cooperation with parents to improve the motivation level of students" ($\bar{X}=3.48$, $S=1.13$). For the individual and social responsibility dimension, the item with the highest agreement rate from teachers was "I encourage my students and their parents to take part in environmental protection activities" ($\bar{X}=3.81$, $S=1.06$), and with the lowest was "I pay regular visits to social assistance institutions such as retirement homes, child protection services, orphanages, etc." ($\bar{X}=2.88$, $S=1.20$). About being against violence, the item with the highest agreement rate from teachers was "When necessary, I shout at students who hinder learning-teaching process (e.g. talking to each other, wandering around in the classroom)" ($\bar{X}=3.60$, $S=1.19$), and with the lowest was "I take physical action to stop students fighting, to ensure discipline (e.g. slapping, pulling ears, making them stand on one leg)" ($\bar{X}=2.39$, $S=1.37$).

Table 1. Teachers' level of ownership of professional values and critical thinking disposition

Scale	n	\bar{x}	S	
Professional Values	1. Being Respectful to Differences	193	3.98	0.68
	2. Individual and Social Responsibility	193	3.50	0.69
	3. Being Against Violence	193	3.12	0.80
	4. Being Open to Cooperation	193	3.73	0.76
	5. Professional Values (Total)	193	3.61	0.45
Critical Thinking Disposition	193	4.05	0.48	

The other purpose of the research is to determine whether teachers' having professional values and critical thinking disposition differ in terms of some variables. Teachers' ownership of professional values does not differ in terms of gender [t (191) =0.15; p>0.05] and subject area [t (191) =0.63; p>0.05]. Similarly, teachers' critical thinking disposition does not differ in terms of gender [t (191) =0.37; p>0.05] and subject matter [t(191)=1.18; p>0.05].

Teachers' having professional values do differ in terms of seniority and location of the school for some dimensions, whereas their critical thinking disposition differs only in terms of the location of the school. Results about the variables with differences are given in Table 2 and Table 3.

As seen in Table 2, teachers' critical thinking disposition significantly differs in terms of the location of their schools [t(191)=2.28; p<0.05]. Critical thinking disposition of teachers working in village middle schools (\bar{X} =4.16, S=0.47) is higher than of those working in town center (\bar{X} =3.99, S=0.48).

Teachers' ownership of professional values, on the other hand, only differs at the "being open to cooperation" dimension of the professional values scale [t (191) =2.84; p<0.05]. Teachers working in town center (\bar{X} =3.84, S=0.75) are more open to cooperation than those working in village middle schools. Table 3 shows the results

Table 2. Comparison of teachers' critical thinking disposition and ownership of professional values as of location of their schools

Scale	Location	n	\bar{x}	S	sd	t	p	
Professional Values	Being Respectful to Differences	City center	124	3.94	0.71	191	1.11	0.26
		Village	69	4.05	0.60			
	Individual and Social Responsibility	City center	124	3.52	0.73	191	0.52	0.61
		Village	69	3.47	0.62			
	Being Against Violence	City center	124	3.06	0.86	191	1.48	0.14
		Village	69	3.24	0.66			
	Being Open to Cooperation	City center	124	3.84	0.75	191	2.84	0.01
		Village	69	3.52	0.73			
	Professional Values (Total)	City center	124	3.61	0.48	191	0.24	0.81
		Village	69	3.62	0.41			
	Critical Thinking Disposition	City center	124	3.99	0.48	191	2.28	0.02
		Village	69	4.16	0.47			

Table 3. Comparison of teachers' critical thinking disposition and their having professional values according to seniority variable

Scale	Seniority (year)	n	\bar{x}	S	sd	F	p	Difference	
Professional Values	Being Respectful to Differences	1. 9 or less	96	4.05	0.65	2-190	8.07*	0.01	1-3
		2. 10-19 year	67	4.08	0.64				2-3
		3. 20 or more	30	3.54	0.68				
	Individual and Social Responsibility	1. 9 or less	96	3.50	0.72	2-190	0.01	0.99	-
		2. 10-19 year	67	3.50	0.65				
		3. 20 or more	30	3.51	0.70				
	Being Against Violence	1. 9 or less	96	3.25	0.78	2-190	3.32*	0.03	1-2
		2. 10-19 year	67	2.93	0.76				
		3. 20 or more	30	3.17	0.87				
	Being Open to Cooperation	1. 9 or less	96	3.75	0.82	2-190	0.96	0.07	-
		2. 10-19 year	67	3.77	0.66				
		3. 20 or more	30	3.55	0.77				
Professional Values (Total)	1. 9 or less	96	3.66	0.51	2-190	2.39	0.09	-	
	2. 10-19 year	67	3.61	0.39					
	3. 20 or more	30	3.45	0.40					
Critical Thinking Disposition	1. 9 or less	96	4.11	0.52	2-190	1.62	0.20	-	
	2. 10-19 years	67	4.02	0.44					
	3. 20 or more	30	3.94	0.41					

Table 4. Relationship between teachers' professional values and critical thinking disposition

Professional Values	Being Respectful to Differences	Individual and Social Responsibility	Being Against Violence	Being Open to Cooperation	Professional Values (Total)
Critical Thinking Disposition	0.52**	0.34**	0.21**	0.31**	0.57**

**< 0.01

of the analysis to compare teachers' critical thinking disposition and their having professional values in terms of seniority variable.

According to Table 3, teachers' critical thinking disposition does not differ in terms of the seniority variable [$F(2-190)=1.62$; $p>0.05$]. Teachers' having professional values, on the other hand, only differs at being respectful to differences [$F(2-190)=8.07$; $p<0.05$], and at being against violence [$F(2-190)=3.32$; $p<0.05$]. The level of being respectful to differences is higher for teachers with less than 20 years of service, compared to those with 20 or more years of service. In addition, the level of being against to violence is higher than for teachers with less than 10 years of service compared to those with 10 to 19 years of service.

The last aim of the study is to determine the relationship between teachers' professional values and their critical thinking disposition. Table 4 includes analysis results for this relationship.

As seen in Table 4, there are significant relationships between teachers' professional values and critical thinking disposition. There is a positive and moderately significant relationship between teachers' critical thinking disposition and being respectful to differences ($r=0.52$), individual and social responsibility ($r=0.34$), being open to cooperation ($r=0.31$) dimension of the professional values scale as well as total professional value score ($r=0.57$). There is a positive and slightly significant relationship between critical thinking disposition and being against violence ($r=0.21$). Items within this dimension for being against violence are negative statements. If one assesses this dimension as it is, that is not after reverse scoring, it may be said that there is a negative relationship between teachers' critical thinking disposition and tendency to violence.

DISCUSSION

The purpose of this study is to determine the relationship between the professional values and critical thinking disposition of science-technology and mathematics teachers working in middle schools. The study, first of all, has determined the teachers' level of professional values, which has been found to be above average. Professional values of teachers are, respectively, being respectful to differences, being open to cooperation, individual and social responsibility, and being against violence. Tunca's (2012) study, conducted on elementary education teachers using the same data gathering tool, provides a similar finding in terms both of teachers' perceiving themselves as having professional values and of order of their professional values. Besides, studies conducted on in service and pre-service teachers' ownership of various professional values show that participants consider themselves sufficient about having such values (Akın & Özdemir, 2009; Karacaoğlu, 2008; Yılmaz, 2011a, 2011b; Yazıcı, 2011).

Teachers consider themselves relatively sufficient for "being respectful to differences". Yılmaz (2006) revealed that teachers embrace, respectively, respect to human beings, democracy, honesty, justice, and diligence. Altınkurt and Yılmaz (2011), on the other hand, found out that professional unethical behaviors least shown by teachers, according to pre-service teachers' opinion, are such behaviors as "forcing students on religious issues", "discriminating students because of their

religious beliefs” or “discriminating students because of their ideology”. Such unethical behaviors’ relevance to “being respectful to differences / not discriminating” supports the results of this study. Additionally, results of the studies by Çoban, Karaman and Doğan (2010) and Yurtseven (2003) also concur with the results of this study.

The study has achieved remarkable and thought-provoking results, particularly when “being against violence” value is interpreted reversely. All items within this dimension of the professional values scale are reverse-written items. The items here include statements about teachers’ actions (e.g. shouting, vituperation, humiliation, and even applying physical violence) towards students with negative attitudes. When these items are not reverse-coded, the arithmetic mean of teachers’ acting in such a manner is 2.87. Considering education as a way of contributing to an individual’s self-realization process, it is obvious to consider the prominence of this value of being against violence. This finding reveals that teachers are still trying to form their students with a basic, fundamental understanding. However education should be a means for liberation, not formalization (Yılmaz & Altınkurt, 2011). Other studies in the literature confirm that teachers approve corporal punishment (Gözütok, 2008), and support physical punishments (Hatunoğlu & Hatunoğlu, 2005).

Teachers’ level of professional values does not differ in terms of gender. In parallel with this result of the study, Tunca’s (2012) study conducted on elementary education teachers with same data gathering tool provides a similar finding in that gender does not cause a difference on professional values of teachers. The same finding is supported by other studies, which have revealed that democratic values held by teachers (Yılmaz, 2011a) and pre-service teachers (Oğuz, 2011; Yazıcı, 2011; Yılmaz, 2011b) do not vary by gender. Nonetheless, there are other studies in the literature that have resulted in differences seen by gender at sub-dimensions of data gathering tools measuring different value types (Dilmaç, Bozgeyikli & Çıkkılı, 2008; Smith & Schwartz, 1997; Şahin-Fırat & Açıkgöz, 2012). This gives rise to think that gender’s impact on values may vary on the type of values and sub-dimensions of each value type.

The level that teachers have professional values does not differ in terms of subject matter. Tunca (2012) found out that teacher’ scores from “individual and social responsibility”, “being open to cooperation” and the overall scale itself differ in terms of their subject matter. Nevertheless, it is possible that this difference is caused by the study’s being conducted on Social Sciences, Turkish Language, Classroom Teaching, Mathematics, and Science-Technology. Dual comparisons conducted to examine the source of this difference have revealed no difference between mathematics and science-technology teachers, which coincides with the results of this study. Besides, there are other studies supporting the result of this study, which shows that teachers’ democratic values differ according to subject matter (Akin & Özdemir, 2009; Yılmaz, 2011a).

The level that teachers have professional values does not differ in terms of the location of their schools. Teachers working in the city center are more open to cooperation than those working in the village schools. The main reason behind this is that teachers in villages are relative to cooperation, and may be limited due to the number of colleagues with which they can cooperate, compared to those in cities (Dağdeviren, 2009; Şekerçi, 2000). Besides, it is possible to consider such problems as “envy, lack of sharing knowledge, ego-centrism, lack of communication, not supporting each other” among teachers working in villages may be the cause of this finding (Dağdeviren, 2009). Items within the “being open to cooperation” dimension of the scale, focus more on teachers’ cooperation with parents. Problems encountered by teachers working in villages including “parents’ not providing their children with sufficient educational tools, parents’ ignoring information and

guidance by teachers, parents' not participating in parent meetings, parents' being not interested in educational problems of their children" (Erdem & Yaprak, 2011) may be considered as the reason for this result.

The level that teachers have professional values does not differ in terms of the seniority variable. The level of being respectful to differences is higher for teachers with less than 20 years of service, compared to those with 20 or more years of service. In addition, the level of being against to violence is higher than for teachers with less than 10 years of service compared to those with 10 to 19 years of service. In parallel to this finding, Tunca (2012) also found out that teachers' having certain professional values differed in terms of the seniority variable. Additionally, it was reported that democratic values of elementary education teachers (Yılmaz, 2011), high school education teachers (Yurtseven, 2003), and administrators (Genç, 2008) varied at sub-dimensions as the seniority variable was concerned. Besides, there are studies in the literature that resulted in organizational values of teachers not varying according to their service years (Zoba, 2000). Thus, it may be said that it is difficult to make a generalization as to whether or not values differ in terms of seniority. Furthermore, in recent years, there are efforts for student-centered and constructivist learning environments, both in curricula and in the overall understanding of teacher training concepts due to modern educational paradigms. Accordingly, it is possible to say that young teachers have a more humanistic perspective towards their students. In support of this finding, Oğuz et al. (2014) reported that teachers with less than 10 years of teaching had a stronger belief in existentialist educational philosophies compared to longer serving teachers.

On the basis of value ranges for CCTDI evaluation (Kökdemir, 2003), critical thinking disposition of science-technology and mathematics teachers is low. This finding has support from many studies conducted with pre-service teachers (Alkın-Şahin, Tunca & Ulubey, 2013; Alper, 2010; Beşoluk & Önder, 2010; Çiçek-Sağlam & Büyükuysal, 2013; Güven & Kürüm, 2008; Korkmaz, 2009; Şen, 2009; Yakar, Altındağ & Kaya, 2010) or teachers (Korkmaz, 2009; Şengül & Üstündağ, 2009; Torun, 2011).

Teachers' ownership of professional values does not differ in terms of gender. Several studies in the literature resulted that gender had not influenced critical thinking disposition on the basis of total score (Ay, Padem & Eriş, 2010; Coşkun, 2013; Ekinci, 2009; Gök & Erdoğan, 2011; Kuvaç & Koç, 2014; Şen, 2009; Tural & Seçgin, 2012). In addition to these supportive studies, there are several studies that have reported significant differences in critical thinking disposition as of gender both on the basis of total score (Alkın-Şahin, Tunca & Ulubey, 2013) and of some sub-dimensions (Kuvaç & Koç, 2014; Tümkaya, 2011; Zayıf, 2008).

Teachers' critical thinking disposition does not differ in terms of subject matter. This finding is supported by some studies which have revealed that different workgroup's scores about a characteristic related to critical thinking do not vary in terms of subject matter or department (Ekinci, 2009; Gülveren, 2007; Hayran, 2000;). However, there are noteworthy studies in the literature resulted in critical thinking disposition of pre-service teachers / university students (Güven & Kürüm, 2008; Tural & Seçgin, 2012; Tümkaya, Aybek & Aldağ, 2009; Zayıf, 2008) as well as critical thinking power (Kürüm, 2002) vary in terms of the department they attend, and teachers' supportive attitude toward critical thinking (Alkın, 2012) varies in terms of their subject matter. One reason for these results' not coinciding with the results of this study may be that these studies examine the difference between social sciences and natural sciences, instead of subject matter or on a departmental basis. This study, on the other hand, examines the difference between mathematics and science, two fundamental fields of study under the natural sciences with relatively strict and firm rules.

Teachers' critical thinking disposition differs in terms of the location of their school. Critical thinking disposition of those teachers working in village middle schools is higher than of those working in city center. It is possible that problems encountered and dealt with relatively alone by village teachers (e.g. lack of colleagues to consult or exchange ideas with, training programs not being in line with rural characteristics, insufficiency of tools, materials and physical facilities, obstacles in communicating within the environment, indifference by parents, low level of readiness by village students compared to those in cities) (Karagöz, 1966, Özpinar & Sarpkaya, 2010; Şekerci, 2000) may have an impact on an increase in their critical thinking disposition. Even though "thinking" consists of various skills (e.g. problem solving, decision making, critical and creative thinking), "thinking skills" are not independent mental skills but intertwined and complicated mental activities complementary to each other (Presseisen, 1991). This is also valid for thinking disposition. Hence, efforts to deal with problems may increase critical thinking disposition.

Teachers' critical thinking disposition does not differ in terms of the seniority variable. Korkmaz (2009) reports that critical thinking disposition of teachers working in various educational levels does not vary in terms of seniority, just like classroom teachers' teaching thinking skills to students (Gelen, 2002). Besides, this finding is indirectly supported by other studies revealing that pre-service teachers' critical thinking disposition does not differ in terms of their grade (Alkın-Şahin, Tunca & Ulubey, 2013; Ekinci, 2009).

There are significant relationships between teachers' professional values and critical thinking disposition. There is a positive and moderately significant relationship between teachers' critical thinking disposition and being respectful to differences, individual and social responsibility, and being open to the cooperation dimension of the professional values scale as well as the total professional value score. There is positive and slightly significant relationship between critical thinking disposition and being against violence. No study could have been found in the literature directly examining the relationship between professional values and critical thinking disposition (or any other variable). Yet, there are several studies conducted and resulted in significant relationship between various value types (e.g. personal values, organizational values, business values, democratic values) and, for instance, personal characteristics (Kubat & Kuruüzüm, 2010; Yıldız & Dilmaç, 2012), happiness (Özdemir & Koruklu, 2011), quality of work life (Taşdan & Erdem, 2010), student control ideologies (Yılmaz, 2011), and attitudes towards the teaching profession (Bektaş & Nalçacı, 2012).

In the light of the research results, it may be recommended to examine how teachers reflect their professional values and their critical thinking disposition into the classroom environment through long-term observations among qualitative research methods. Although there are several studies in the literature about values, there has been limited research about the professional values of teachers. Hence, it is difficult to make a generalization on whether teachers' professional values differ in terms of certain variables. In this regard, it is possible to work with larger samples to see the impact of relevant variables as well as various personal and profession variables on professional values. In order to be able to make stronger emphasis on the relationship between professional values and critical thinking disposition, research studies may be conducted with larger groups via different measurement tools measuring both structures.

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