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A Comparison of Turkish and German Mathematics Teachers' Values: A Gender Perspective

Türk ve Alman Matematik Öğretmenlerinin Değerlerinin Karşılaştırılması: Cinsiyet Perspektifi

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Abstract

This research was based on the data obtained from "Values in Mathematics Teaching in Turkey and Germany" [VMTG] project and it has examined whether gender and nationality influence values of mathematics teachers. The methodology used in this research was a descriptive quantitative method. The participants of the study were twenty-seven German and thirty-three Turkish mathematics teachers. Data analysis involved both descriptive and inferential statistics. Effect sizes were also calculated. The findings revealed that: (1) the interaction effect between nationality and gender group was not statistically significant; (2) the main effect for gender did not reach statistical significance; and (3) there was a statistically significant main effect for nationality.

Key Words: Mathematics, values, gender, nationality, Turkish and German mathematics teachers, comparison.

Öz

Bu çalışma, "Türkiye ve Almanya'da Matematik Öğretiminde Değerler" adlı projeden elde edilen verilere dayanmaktadır ve matematik öğretmenlerinin değerlerinin üzerinde cinsiyetin ve milliyetin etkisinin olup olmadığını incelemiştir. Çalışma, nicel yönteme dayalı betimsel bir çalışmadır. Çalışmanın katılımcıları, 33 Türk ve 27 Alman matematik öğretmenidir. Analizler, betimsel ve yordayıcı istatistikleri içermektedir. Etki büyüklüğü değerleri de hesaplanmıştır. Sonuçlar, (1) cinsiyet ve milliyet grupları arasındaki etkileşim etkisinin anlamlı olmadığını; (2) cinsiyet için temel etkinin istatistiksel olarak anlamlı olmadığını ve (3) milliyet için temel etkinin istatistiksel olarak anlamlı olduğunu göstermiştir.

Anahtar Kelimeler: Matematik, değerler, cinsiyet, milliyet, Türk ve Alman matematik öğretmenleri, karşılaştırma.

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Introduction

This paper describes the specific results of a wider comparative study concerning Turkish and German mathematics teachers' values. The main focus was on the gender of the mathematics teachers. The interactions related to nationality were also taken into consideration in the study. The methodology employed in this research was a descriptive quantitative study. The reasons behind the choice of these two countries were as follows: *(a)* Turkey is different from Germany in some points, mainly in culture, language, and religion. Turkey is seen as a bridge between Eastern and Western cultures and has taken series step for Westernization. On the other hand, The Federal Republic of Germany represents Western, liberal culture and has a multicultural society, *(b)* it is thought that this comparison may provide a significant contribution to the literature and discussion concerning which values may be transferred to immigrated students (with foreign nationalities), particularly Turkish students in Germany, as the students in Germany come from a multicultural background, whereas Turkish students come from a homogeneous background, and *(c)* when the literature on values in mathematics education was searched, no study was encountered investigating a comparison of Turkish and German mathematics teachers in general, or on their values in particular.

The VMTG Project

The main goals of the research project are briefly given below: *(a)* to compare the Turkish and German mathematics teachers' values towards mathematics and mathematics education. For this purpose, both qualitative and quantitative research methods were used (Stake, 1995; Yin, 2003). For this aim, a questionnaire was developed in order to identify mathematics education values of mathematics teachers (Dede, 2011). Then a detailed interview protocol was also prepared to investigate in-depth mathematics teachers' mathematics and mathematics education values, *(b)* to investigate which mathematics educational values the teachers actually convey to their mathematics teaching via classroom observation, and *(c)* to investigate to what extent teachers convey the mathematical values that they have to the classroom environments. For this aim, semi-structured interviews were conducted with students from Turkey and Germany to get detailed and in-depth information. However, attention in this paper was focused on the first of these goals and was only presented some data (gender and nationality) coming from the questionnaire survey of the teachers.

Mathematics Teaching in Turkey and Germany

There are some differences in the content of mathematics teaching in Germany and Turkey. Even though the implementation of education varies among the 16 states in Germany, the Standing Conference (Kultusministerkonferenz) coordinates Ministry of National Education's works in each state (Riley, McGuire, Conaty, & Dorfman, 1999). In the international studies, German students obtained near to international average score in the field of literacy, mathematics and natural sciences. However, these scores were observed to be very poor when compared with some Asian and Europan countries (Misek, 2007; Schumann, 2000).

In Turkey, Ministry of National Education [MEB] for Elementary and Secondary Education, and Higher Education Council [YÖK] for Higher education are responsible bodies for educational planning, implementation and coordination. The national and international comparative studies on mathematics teaching have indicated that Turkish students' mathematics achievement were observed to be lower than the mathematics achievement of the students in other countries (Education Research and Development Directorate [EARGED], 2005). In order to overcome this problem in Turkey, primary school and secondary school mathematics curricula have been newly developed on the basis of constructivist approaches (see MEB, 2009a, MEB, 2009b). Then, accreditation of faculties of education based on constructivism was started in 1997 and continued in successive years till 2007. However, while Turkey signed the Bologna Reform agreement in 2001, Germany signed it in 1999. Therefore, Bachelors and Masters Systems in both countries are now updated based on the Bologna Accords.

Values

The Importance and Role of Values

Values are general guide for the behavior emerging from one's experiences and relations in one's life (Raths, Harmin, & Simon, 1987). According to this, values play a role on one's decisions, selections, and behaviors unconsciously or consciously (FitzSimons et al., 2001). On the other hand, Swadener and Soedjadi (1988) perceived the values as an idea or concept which is related to the worth of anything. Seah (2003: 2) adopted a similar approach and regarded a value as "an individual's internalization, 'cognitisation' and decontextualization of affective constructs (such as beliefs and attitudes) in his/her socio-cultural context". Bishop (2001: 347) also emphasized the importance of values as follows;

> Values exist on all levels of human relationships. On the individual level, learners have their own preferences and abilities that predispose them to value certain activities more than others. In the classroom, values are inherent in the negotiation of meanings between teacher and students and among the students themselves. At the institutional level, we enter the political world. Here, members of organizations engage in debates about both deep and superficial issues, including priorities in determining local curricula, schedules, teaching approaches, and so on. The larger political scene is at the societal level, where powerful institutions determine national and state priorities for mathematics curricula, teacher-preparation requirements, and other issues. Finally, at the cultural level, the very sources of knowledge, beliefs, and language influence our values in mathematics education.

In this sense, education is essentially a cultural value-laden issue (Gudmundsdottir, 1991) and the transmission of culture and values is one of the aims of the education. Schools are key institutions where this function is realized and sustained (Osler & Starkey 2001). In this regard, curriculums are designed around values and values are integrated with other disciplines in the curriculum (Demirhan & Senemoglu, 2009). From this perspective, it can be said that value-free education is therefore unlikely in most countries, and values are apparent in school curricula, goals, and activities, as well as in the requirements set by the state (Powe, 1993). For example, Wong, Wong and Wong (2012) have discussed how three essential Chinese schools of thought (Confucianism, Buddhism, and Daoism) might impact education in general and mathematics education in particular.

Teacher Values

Values have an impact on teachers' decision and behaviors (Fasheh, 1982). Besides, decision making skills of the teachers are associated with their prior experience, beliefs and values, teaching aims and objectives, decision schema, teaching situation, and decision and action (Bishop & Whitfield, 1972). Similarly, Gudmunsdottir (1991) saw values as the guide of teachers' practices. Clarkson (2007) also indicated that students carefully monitored their own teachers' behaviors, understood the values their teachers held and showed a reaction which was suitable for their monitor. Frade and Machado (2008) also found that teachers' values strongly impact upon students' mathematical attitudes, beliefs, and feelings. Seah (2002), Swadener and Soedjadi (1988), and Chin and Lin (2001) also viewed the values as personal decisions and preferences related to individual standards for opinions and behaviors which are considered as worthwhile and important.

Mathematics Pedagogy, Values, and Culture

According to Ernest (2008:3),

> … absolutist philosophies of mathematics deny that values have any place or relevance with respect to mathematical knowledge. In contrast fallibilism asserts that mathematics is human and hence imbued with human values.

Seah and Bishop (2002) and Seah (2003) also emphasized that education in general and mathematics education in particular portray the values actively and transfer these values. Hence, two different viewpoints (absolutist and fallibilist view) related to mathematical philosophy have different effects on teaching practices (Ernest, 1991).

The research on values in mathematics teaching appeared in 1980s by integrating them to cultural dimensions of mathematics education (Bishop, 2004). Bishop (1996) classified three types of values observed in the mathematics classrooms. They are general educational, mathematical, and mathematics educational values. Bishop (1998) indicated as examples of general educational values, honesty and good behavior. Bishop (2004) described three pairs of complementary mathematical values in the Western culture as (i) rationalism and objectivism, (ii) control and progress, and (iii) openness and mystery. Bishop (2004) also conceptualized mathematics educational values as being formalistic view and activist view, instrumental understanding and relational understanding, relevance and theoretical knowledge, accessibility and special, evaluating and reasoning. According to this, educational values are related to general societal values, mathematical values are related to the scientific discipline of mathematics, and mathematics educational values are related to pedagogy of mathematics that is, to practices and norms emerging from mathematics instruction (Atweh & Seah, 2008; Seah & Bishop, 1999). On the other hand, according to Stigler and Perry (1988: 195),

> … mathematics would seem to be the one subject least affected by culture. After all, numbers are numbers, and basic mathematical operations should function the same across cultures.

However, Bishop (1988:182) declared mathematics as "… conceived of as a cultural product, which has developed as a result of various activities". Similarly, Butty (2001) also viewed mathematics as a culture. National Council of Teachers of Mathematics [NCTM] (2000) also saw mathematics as a part of cultural heritage. In this sense, approaches to mathematical studies vary in terms of cultures, time, and communities (Lancaster, 2006). Furthermore, cultural differences influence how the same mathematical content can be taught using different teaching approaches, and different cultures affect the associated values (Seah, 2003). Thus, since mathematics teaching varies from one culture and educational system to another, mathematics educational values may vary accordingly (Atweh & Seah, 2008). For example, in a research conducted with Turkish pre-service mathematics teachers, Dede (2011) reported that some of the mathematics educational values (e.g., accessibility-special) common in European culture were not accepted.

Mathematics, Values, Gender, and Achievement

Mathematics has been historically seen as the preserve of white ethnic majorities, males, middle-class (Leder, Forgasz, & Taylor, 2006). It has long been accepted that gender differences in turn influence performance on mathematics tests, and in course-taking, and career planning (Hyde, Fennema, Ryan, Frost, & Hopp, 1990). Moreover, it has also long been thought that females have more abilities in verbal skills than males, but unlike males are better at spatial skills than females. This view is thought to be the reason males generally performed better on mathematics tests (James, 2007) and it would affect males and females skills in mathematics (Tocci & Engelhard, 1991). However, these differences are no longer seen; the only persistent gender difference appears to be in tasks involving mental rotation of objects (Levin, Mohamed, & Platek, 2005). Scantlebury (2009) also has asserted that teachers' gender biases can cause stereotypic expectations for students' success. Teachers also attribute boys' and girls' success to their talent and their hard work respectively (Leedy, LaLonde, & Runk, 2003). However, Turkish mathematics teachers also think that students' gender has no effect on their mathematics achievements (Dursun and Dede, 2004). Lim and Ernest (1998) also showed that the public's images of mathematics are closely related to their feelings and attitudes towards mathematics. These epistemological development and philosophical theories of moral have also strongly influenced studies on mathematics education and gender (Davis, Ernest, Gamoran, Gerdes, & Sharygin, 2004). Inglehart and Brown (1987) also determined that affective orientations can be interpreted as clear evidence, especially values, in explaining gender differences in academic achievement. In this point, a theory of the gendered nature of values has proposed by Gilligan (1982) and Ernest (1995: 455) has elaborated this theory as below:

> According to this theory it is possible to distinguish stereotypically feminine values, which Gilligan terms 'connected', from stereotypically masculine values which she terms 'separated'. …The 'connected' position is based on and valorizes relationships, connections, empathy, caring, feelings and intuition, and tends to holistic and human-centred in its concerns. The 'separated' position valorizes rules, abstraction, objectification, impersonality, unfeelingness, dispassionate reason and analysis, and tends to be atomistic and thing-centred in focus.

However, in Ernest's (2008) opinion, these two clusters of contrasting values not generally applied to mathematics (Ernest, 2008) and must be revised in terms of two viewpoints (Ernest, 1995: 455):

> First of all, it is not the case that separated values are men's values and connected values are those of women. They can be described as stereotypically masculine and feminine values, respectively. But every human being has both a masculine and feminine component to their nature. We are one species and male/female differences are not so profound as our commonalities. Second, reviews of empirical evidence do not support any easy dichotomization of male and female values.

Besides, Ernest (2004) also asserted that separated and connected values are in strongly accordance with the absolutist conception and the fallibilist conception of mathematics, respectively.

Purpose and Importance of the Study

The paper is important as it not only compares Turkish and German teachers and thus contributes to the broader field of cross-cultural comparative studies but also it is a very good example of how a complex situation (teacher values under different cultural and administrational conditions) can be made researchable by operation of theoretical antecedents. On the other hand, the paper contributes empirically to the saturation and development of theories of values in the mathematics education research literature. In particular, there has been a long history of gender differences in various aspects of mathematics learning, inclusive performance, attributions, values, beliefs and attitudes, etc. Previous investigations such as the Values and Mathematics Project (VAMP) and the Values in Mathematics Teaching (VIMT) have showed that the role of values and their importance are placed and also content-specific in mathematics education (Leu &Wu, 2000). These studies have shown the role played by values in mathematics teaching and education; but there are not many studies focused on finding out or measuring in-service teachers' mathematics-related values across cultures, which influence a person's choices and behaviors (Yero, 2002). Values influence teachers' decisions and actions (Fasheh, 1982); therefore, the reasons of the behavior and the teaching practices and preferences can be best understood through examining teachers' mathematical values. Furthermore, a cross-national study of teachers' values can be particularly important because the comparison of two different socially and culturally embedded value systems can explicitly make implicit values more transparent (Correa, Perry, Sims, Miller, & Fang, 2008). In this regard, this study reported a small part of the results obtained from the VMTG project. Specifically, the research attempted to address following questions:

1. Do mathematics teachers' values differ for male and female mathematics teachers?
2. Do mathematics teachers' values differ for teacher's nationality?
3. Do mathematics teachers' values between the teacher's nationalities vary as a function of gender?

Method

Research Design

Due to the nature of the values, quantitative approaches require subjective and arguable understanding. For this reason, the studies focusing on values in mathematics education have generally been designed as qualitative approaches (Seah, 2008). However, when looking at the literature, beliefs (and values) were measured using a variety of techniques (i.e., questionnaires, interviews, content analysis of journal entries, reflections, and observations) (Leder & Forgasz, 2002). Denscombe (2010) also stated that opinions, attitudes, views, values, beliefs, preferences, etc. can also be examined using questionnaires. And especially in the second half of the 2000s, the research agenda of values in mathematics education included the designing and validation of tools that assess what students (Dede, 2006, Seah & Peng, 2012) and teachers value in mathematics pedagogy ((Dede, 2011, Seah & Peng, 2012).

This research was based on the data revealed from the VMTG project. The methodology employed in this research was a descriptive quantitative approach and some parts of the data collected through a questionnaire were reported. It was thought that such a questionnaire could provide valuable information about teachers' mathematics education values. In this research, the main focus was on the gender of the mathematics teachers. Interactions related to nationality were also of interest. Moreover, mathematics curriculum includes both implicit and explicit values. Therefore, implicit values were conveyed in a hidden manner, acquired in more subtle ways, and evidenced in the learner's behavior. The explicit values were planned explicitly, applied in the classrooms, and acquired from the instruction. In the current study, the explicit values mentioned by the teachers and to be acquired by learners have been analyzed using a Likert type questionnaire, whereas implicit values not considered in the research would need to be based on more inferential data sources (i.e., classroom observations) (Dede, 2011). Therefore, the definition of value adopted in the current study can be viewed as personal preferences for stating if a thought and statement are of worthwhile and importance for the individual (Chin & Lin, 2001; Seah, 2002; Swadener & Soedjadi, 1988).

Participants

The participants of the study were selected based on a combination of purposeful and convenience sampling methods. Purposeful sampling method was used as a means of selecting information rich cases for this investigation (Patton, 1990). The maximum variation sample is a special kind of purposeful sampling method and, in this study, it was used to capture mathematics teachers' values from gender and nationality. On the other hand, convenience sampling method was used because the teachers were chosen on the basis of their willingness and accessibility to participate (Gravetter & Forzano, 2008), as it fits the goals of the research and is much more convenient (Gall & Borg, 1996), and "… is built upon selections which suit the convenience of the researcher and which are 'first to hand.' " (Denscombe, 2010: 37). With these sampling methods, all of the German mathematics teachers were selected from primary and secondary schools in Berlin, whereas thirty-one of the Turkish mathematics teachers were from primary and secondary schools in Sivas and two from Ankara. So, the teachers were twenty- seven German mathematics teachers and thirty-three Turkish mathematics teachers.

Turkish teachers of the study include 17 primary school mathematics teachers (*gender:* 10 female and 7 male; *years of experience/ seniority*: teachers with 1-5 years of experience: 9, teachers with 6-10 years of experience: 6, teachers with 11-15 years of experience: 0, teachers with 16-20 years of experience: 0, and teachers with over 20 years of experience: 1. One primary school mathematics teachers did not mark her/his seniority) and 16 high school mathematics teachers (*gender:* 4 female and 12 male; *years of experience/ seniority*: teachers with 1-5 years of experience: 1, teachers with 6-10 years of experience: 5, teachers with 11-15 years of experience: 4, teachers with 16-20 years of experience: 2, and teachers with over 20 years of experience: 4). According to this data, twenty-one of Turkish teachers graduated in 1997 from the Faculty of Education, Department of Mathematics Education of which curricula were revised and re-designed based on constructivist approaches.

On the other hand, German teachers of the study include 15 primary school mathematics teachers (*gender:*12 female and 3 male; *years of experience/ seniority*: teachers with 1-5 years of experience: 1, teachers with 6-10 years of experience: 2, teachers with 11-15 years of experience: 2, teachers with 16-20 years of experience: 1, and teachers with over 20 years of experience: 9) and 12 high school mathematics teachers (*gender:* 8 female and 4 male; *years of experience/ seniority*: teachers with 1-5 years of experience: 2, teachers with 6-10 years of experience: 2, teachers with 11-15 years of experience: 2, teachers with 16-20 years of experience: 3, and teachers with over 20 years of experience: 3). According to their level of teaching experience, most of the German teachers surveyed in the current study have passed through the old Staatsexamen system. However, the focus of this paper was only to examine teachers' gender and nationality effects on their mathematics education values.

Data Collection

The MEVQ, used instrument to assess mathematics teachers' values, was selected as the main data collection tool for this study. A brief information about the MEVQ is given below:

The MEVQ was developed by Dede (2011) within the VMTG project and was prepared as a five-point Likert-type rating scale. The participants were asked to indicate their level of support for each item in the questionnaire, ranging from "strongly oppose = 1" to "strongly support = 5". Furthermore, all negative-worded items were reflected (5 = 1, 4 = 2, 3 = 3, 2 = 4, 1 = 5) to provide a consistent score for all items. The MEVQ entire scale accounted for 63.32% of the variance, with the first subscale (factor 1) accounting for 25.69% of the variance, the second subscale (factor 2) accounting for 15.14%, the third subscale (factor 3) accounting for 11.29%, and the fourth subscale (factor 4) accounting for 11.19%. The acceptable Cronbach's α (coefficients > 0.70) for the entire questionnaire and subscales (factors) confirmed the satisfactory internal consistence of the MEVQ (see Field, 2002). Finally, The MEVQ consisted of 15 items in four different sub-categories and the four factors could be labeled and described as follows (in order of factors):

Factor 1: Reducing the theoretical nature and basis of mathematics teaching (TMT): Teaching mathematics in the abstract and with only a theoretical base does not relate to daily life. This factor includes seven items. Sample items: #Examples from daily life should not be used in teaching mathematics; #A mathematical problem should not be solved by methods that are different from already taught ones.

Factor 2: Giving support to concrete mathematics teaching (CMT): Mathematics teaching should be taught by concretizing it, there should be more emphasis on conceptual learning, and it should be continuously updated. This factor includes four items. Sample items: #Alternative solutions and proofs should be used as much as possible in teaching mathematics; #Mathematics curricula always should be updated according to new teaching methods, strategies, and techniques.

Factor 3: Giving importance to values in mathematics teaching (VMT): The textbooks and mathematics curricula are inaccurately presented as value-free. This factor includes two items. Sample items: #Mathematics curricula should not include values; #Mathematics textbooks should not include values.

Factor 4: Assigning importance to both affective and cognitive outcomes in mathematics teaching (ACMT): Mathematics curriculum should emphasize the importance of affective outcomes as well as cognitive outcomes. This factor includes two items. Sample items: #Mathematics curricula should not take the affective learning outcomes into account; #Mathematics curricula should emphasize just cognitive learning outcomes)(see Dede 2011, for details about the MEVQ).

In the MEVQ, the TMT reflects the protection of the essence (Wang, Lin, Chin, & Chang, 2006). That is, these values see the mathematics as "separate knowing" (Ocean, 2005: 137) or "separated" values (Ernest 1995: 449). Put another way, it is indicated that mathematics is value-free and reflects the views of absolutist philosophers (Ernest, 1998, 2007, 2008). On the contrary, the CMT reflects intuitiveness, creativity, models, induction, tolerant and, relativity. In other words, it is indicated that mathematics is culture-laden, value-laden, and reflects the views of fallibilist philosophers (Ernest, 1998, 2007, 2008). In other words, they see mathematics as "connected knowing" (Ocean, 2005:137) or "connected" values (Ernest, 1995: 449). The VMT reflects that mathematics curricula and textbooks are inaccurately presented as value-free. The ACMT also indicates that mathematics curricula should emphasize the importance of affective outcomes as well as cognitive outcomes. The entire MEVQ also generally refers to "connected knowing" (Ocean, 2005:137) or "connected" values (Ernest, 1995: 449).

Procedure

The MEVQ was administered to the teachers during the Spring term of 2009 in Turkey and Germany. It took about fifteen minutes to complete the questionnaire. The purpose of the research clearly explained to the teachers by the researcher. Furthermore, the researcher ensured that teachers' responses of the questionnaire would be confidential.

Data Analysis

Analysis involved descriptive and inferential statistics. Descriptive statistics were calculated to provide means and standard deviations. The dependent variables of the study: the MEVQ's sub-scales scores, that is (a) TMT, (b) CMT, (c) VMT, and, (d) ACMT. And two independent variables: (a) gender and (b) nationality. Although the study includes a factorial model with the four factors and two independent variables, the two-way multivariate analysis of variance (MANOVA) was not performed on the data because MANOVA works best when the dependent variables are only moderately correlated. With low correlations, separate analysis of variance (two-way ANOVA) should perform for the dependent variables (Pallant, 2007). In present study, the correlation analyses revealed generally low correlations ($r < .30$) among the dependent variables (Cohen, 1988). Therefore, a series of univariate analysis of variance (two-way ANOVAs) were separately conducted to compare gender and nationality effect on each of the dependent variable scores. Cohen's d effect sizes were also calculated. Based on Cohen's standard, the effect size is small if eta-squared is 0.02, medium if eta-squared is 0.06, and large if eta-squared is 0.14 (Cohen, 1988).

Findings

The results of the research are presented according to the research questions and the order of the MEVQ's subscales.

1) Reducing the theoretical nature and basis of mathematics teaching (TMT)

The means and standard deviations for the TMT subscale as a function of nationality and gender are presented in Table 1.

Table 1
Mean and Standard Deviations for the TMT Subscale

Gender	*Nationality*								
	German			*Turkish*			*Total*		
	Mean	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*
Female	4.48	0.40	20	4.20	0.75	14	4.37	0.58	34
Male	4.63	0.16	7	4.07	0.60	19	4.22	0.57	26
Total	4.52	0.36	27	4.13	0.66	33	4.30	0.58	60

A two-way between-groups analysis of variance was conducted to explore the impact of gender and nationality for the TMT value. The interaction effect between gender and nationality group was not statistically significant, $F(1, 56) = 0.77$, $p= 0.39$. There was a statistically significant main effect for nationality $F(1, 56) = 7.18$, $p= 0.10$, partial eta-squared = 0.11. Effect size indicates a medium effect (partial eta-squared = 0.11). The nationality main effect indicated that German mathematics teachers (Mean = 4.52, SD =0.36) further support TMT value compared to their Turkish colleagues (Mean = 4.13, SD = 0.66). The main effect for gender, $F(1, 56) = 0.00$, $p = 0.97$, did not reach statistical significance.

Giving support to concrete mathematics teaching (CMT)

A 2x2 ANOVA was performed to evaluate the effects of nationality and gender on the CMT subscale. The means and standard deviations for the CMT subscale as a function of the two factors are summarized in Table 2.

Table 2

Mean and Standard Deviations for the CMT Subscale

Gender	*Nationality*								
	German			*Turkish*			*Total*		
	Mean	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*
Female	4.61	0.38	20	3.97	0.78	14	4.35	0.65	34
Male	4.79	0.25	6	4.01	0.68	19	4.20	0.69	25
Total	4.65	0.36	26	3.99	0.71	33	4.29	.67	59

The ANOVA revealed no significant interaction between nationality and gender, $F(1, 55) = 0.14$, $p= 0.70$, and no significant main effect for gender, $F(1, 55) = 0.44$, $p= 0.51$, but significant main effect for nationality, $F(1, 55) = 17.16$, $p= 0.00$, partial eta-squared = 0.24. Effect size indicates a large effect (partial eta-squared = 0.24) for the CMT value. The nationality main effect indicated that German mathematics teachers (Mean = 4.65, SD =0.36) further support CMT value compared to their Turkish pairs (Mean = 3.99, SD = 0.71).

Giving importance to values in mathematics teaching (VMT)

The means and standard deviations for the VMT subscale as a function of gender and nationality are illustrated in Table 3. A two-way between-groups analysis of variance was performed to explore the impact of gender and nationality for the VMT value. The interaction effect between gender and nationality group was not statistically significant, $F(1, 54) = 0.71$, $p= 0.80$. There was a statistically significant main effect for nationality $F(1, 54) = 9.25$, $p= 0.04$, partial eta-squared = 0.15. Effect size indicates a large effect (partial eta-squared = 0.15). The nationality main effect indicated that Turkish mathematics teachers (Mean = 3.98, SD = 0.97) further support VMT value compared to their German partners (Mean = 3.12, SD = 1.12). The main effect for gender, $F(1, 54) = 0.00$, $p= 0.96$, did not reach statistical significance.

Table 3

Mean and Standard Deviations for the VMT Subscale

Gender	*Nationality*								
	German			*Turkish*			*Total*		
	Mean	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*
Female	3.10	1.20	19	4.03	0.58	14	3.50	1.07	33
Male	3.17	0.99	6	3.94	0.91	19	3.76	0.97	25
Total	3.12	1.12	25	3.98	0.77	33	3.61	1.03	58

Assigning importance to both affective and cognitive outcomes in mathematics teaching (ACMT)

A 2x2 ANOVA was conducted to test the effects of nationality and gender on the ACMT subscale. The means and standard deviations for the ACMT subscale as a function of the two factors are shown in Table 4.

Table 4

Mean and Standard Deviations for the ACMT Subscale

Gender	*Nationality*								
	German			*Turkish*			*Total*		
	Mean	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*
Female	3.94	0.72	19	3.07	1.01	14	3.58	0.96	33
Male	4.41	0.38	6	3.40	0.99	19	3.64	0.97	25
Total	4.06	0.68	25	3.25	0.99	33	3.60	0.95	58

The ANOVA showed no significant interaction between nationality and gender, $F(1, 54) = 0.08$, $p= 0.77$, and no significant main effect for gender, $F(1, 54) = 2.41$, $p= 0.12$, but significant main effect for nationality, $F(1, 54) = 13.85$, $p= 0.00$, partial eta-squared = 0.20. Effect size indicates a large effect (partial eta-squared = 0.20) for the ACMT value. The nationality main effect indicated that German mathematics teachers (Mean = 4.06, SD = 0.68) further support ACMT value compared to their Turkish pairs (Mean = 3.25, SD = 0.99).

As can be seen from Table 1 through Table 4, comparison of the gender/nationality cell means shows that (a) German mathematics teachers (both female and male) had higher mean scores than their Turkish colleagues (both female and male) for TMT, CMT, and ACMT, while Turkish mathematics teachers (both female and male) had higher mean scores than their German colleagues (both female and male) for VMT, (b) German male mathematics teachers had higher mean scores than their German female peers in all possible comparisons, (c) Turkish female mathematics teachers had higher mean scores than their Turkish male peers for TMT and VMT while Turkish male mathematics teachers had higher mean scores than their Turkish female peers for CMT and ACMT, (d) German female mathematics teachers had higher mean scores than their Turkish male peers for TMT, CMT, and ACMT, while Turkish male mathematics teachers had higher mean score than their German female peers for VMT, (e) German male mathematics teachers had higher mean scores than their Turkish female peers for TMT, CMT, and ACMT, while Turkish female mathematics teachers had higher mean score than their German male peers for VMT, and (f) Considering the mean scores of males and females, regardless of nationality, females had higher mean scores than the males for TMT and CMT, with a mean value of 4.37 (4.22) and 4.35 (4.20) respectively, while males had higher mean scores than the females for VMT and ACMT, with a mean value of 3.76 (3.50) and 3.64 (3.58) respectively. In terms of the five-point Likert scale, these means indicate that the values expressed toward the TMT and CMT were very positive ($M > 4.0$), and the VMT and ACMT were positive ($M > 3.5$ but < 4.0) in both female and male group.

Discussion

This section has considered mathematics teachers' nationality and gender effects in mathematics education values, and limitations and implications for future cross-comparative research.

Nationality Effect in Mathematics Education Values

The first set of findings from the study showed that nationality has strongly effect on the mathematics teachers' mathematics education values. The results indicated that German mathematics teachers had significantly higher mean scores than their Turkish colleagues for TMT, CMT, and ACMT, while Turkish mathematics teachers had significantly higher mean scores than their German colleagues for VMT. The results for these Turkish and German mathematics teachers need to be considered in terms of national and international mathematics education goals and in terms of absolute and relative results. As it can be seen from Table 1 through Table 4 above, in terms of the five-point Likert scale, the values stated by German mathematics teachers toward the TMT (factor 1), CMT (factor 2), and ACMT (factor 3) subscales were very positive ($M > 4.0$), and the VMT (factor 3) subscale was somewhat neutral (M~3.0), whereas the values expressed by Turkish mathematics teachers toward the TMT (factor 1), CMT (factor 2), and VMT (factor 3) subscales were almost very positive ($M > 4.0$), while those stated about the ACMT (factor 4) subscale was somewhat neutral (M~3.0). Besides, these results reveal that these Turkish and German teachers were generally stating values compatible with the international mathematics education reforms (e.g., NCTM, 2000) and the mathematics education curricula in Turkey and Germany (MEB 2009a, b, Rahmenlehrplan für die Sekundarstufe 1 [RSS], 2006; Rahmenplan Grundschule Mathematik [RGM], 2004). The results of the present study are found to be parallel with the study carried out by Dede (2011) in which he investigated Turkish pre-service mathematics teachers' mathematics education values. Furthermore, the results of the present research are also compatible with the qualitative study of Dede (2012). This qualitative study contained different specific results from the VMTG project and it examined to identify why mathematics is valuable to Turkish and German mathematics teachers. The study concluded that the mathematical values of mathematics teachers in both countries can be grouped into two categories: Isolated thinking and connected thinking. However, within this overall conceptual structure both similarities and differences do occur. Thus, the values of usefulness, rationalism, reasoning, communication, flexibility, aesthetics, tool, and applicability were emphasized by the teachers in both groups. So the study supported the general observation that mathematics teachers in different cultures hold common perspective with regard to scientific disciplines of mathematics such as rationalism (Atweh & Seah, 2008). Furthermore, Turkish teachers, to a higher degree that German teachers, relate mathematics with connected thinking than with isolated thinking. These results for Turkish data might be perhaps explained as above in terms of the curricula of the Education Faculties in Turkey. Because, 64% of the Turkish sample (twenty-one teachers) graduated in 1997 from the Faculty of Education, Department of Mathematics Education whose curricula were revised and re-designed based on constructivist approaches. This point is important because some researches showed that teacher education programs influence student teachers' beliefs, even values (see Borko et al., 1992).

On the other hand, the results related to the German teachers are generally compatible with the objectives and expectations of the primary and secondary I and II level mathematics curricula (see RGM, 2004; RSS-I, 2006; Rahmenlehrplan für die Gymnasiale Oberstufe [RGO], 2006). The goal of these curricula is to develop students' skills in arguments; problem solving; modeling; presentation; using symbolic, formal and technical elements of mathematics; and communication. These skills generally reflect "connected" values (Ernest, 1995, p. 449) and "connected thinking" (Dede, 2012). The German samples also generally adopt these values. However, on this point, some German researchers have found different findings concerning German mathematics teachers' beliefs (or mathematical world views). In this regard, Törner (1997) and Grigutsch, Raatz, and Törner (1998) categorized German mathematics teachers' mathematical world views (beliefs) in four categories. These include: (a) the aspect of formalism (F), (b) tool or schematic orientation aspect (S), (c) the aspect of process (P), and (d) the aspect of application (A). A and P reflect dynamic aspect of mathematics, whereas S and F reflect the static aspect of mathematics. Considering the findings of the present study, A and P can be considered to be within the entire MEVQ. Moreover, Grigutsch et al. (1998) determined that most German mathematics teachers who attended teacher training had A and P views. Contrary to Grigutsch et al. (1998), Kaiser (2006) found that German mathematics teachers had F and S mathematical world views. Furthermore, Maass (2009) also determined two types of German mathematics teachers holding dynamic and static views of mathematics (e.g., learning process teacher and transmission teacher).

Moreover, when compared to values documented in other studies, the values stated by this sample of teachers were similar, somewhat higher, or drastically more positive than the values stated by other samples for similar instruments. Bishop, Clarkson, FitzSimons, and Seah (2002) found that the Australian mathematics teachers in the VAMP project tacitly supported values in mathematics teaching (clarity, flexibility, open mindedness, efficient working, persistence, etc.) expressed in curriculum resources. Some of these values can be seen in the factors 1 and 2 of the MEVQ. However, other studies have demonstrated an order for mathematics educational values (most to least) of problem solving, investigations, small-group work, …, team teaching, and testing (FitzSimons et al., 2000). Lin, Wang, Chin and Chang (2006) determined that the Taiwanese student teachers in the VIMT project were aware of the values (i.e., mathematical essence, mathematical communication, reasoning, and learning with pleasure). However, teachers' actual implementation of these values into their teaching is determined by the closeness of the relation among their willingness to actualize these values, substance, awareness, and classroom environment. Furthermore, different cultures have different values and tensions that the teachers must cope with and resolve. Taiwanese teachers in the VIMT project were more interested in willingness than individual awareness, while the Australian teachers in the VAMP were more concerned with special educational values, personal consciousness, and tensions of value teaching. These results obtained from teachers in different cultural background are important to show that mathematical studies differentiates across culture, time, and society (Lancaster, 2006), cultural difference is a factor that have an impact on mathematics teaching (Lim, 2003), different cultures hold different values (Bishop, Clarkson, FitzSimon, & Seah, 2000).

Gender Effect in Mathematics Education Values

The second set of findings from the study indicated that the main effect for gender did not reach statistical significance. This result revealed that it may not be important to consider gender effect when studying values in mathematics education. However, considering the mean scores of males and females, regardless of nationality, females had higher mean scores than the males for reducing the theoretical nature and basis of mathematics teaching and concrete mathematics teaching (first two factors of the MEVQ), while males had higher mean scores than the females for importance to values in mathematics teaching and importance to both affective and cognitive outcomes in mathematics teaching (last two factors of the MEVQ). These findings of the Turkish and the German samples are generally consistent with the theory of Gilligan (1982) in the Western context. Besides, comparison of the gender/nationality cells means in Table 1 through Table 4 showed that German male mathematics teachers had higher mean scores than their German female peers in all possible comparisons. Turkish female mathematics teachers also had higher mean scores than their Turkish male peers for TMT and VMT, while Turkish male mathematics teachers had higher mean scores than their Turkish female peers for CMT and ACMT. These findings of the Turkish sample are generally consistent with the study of Dede (2011) in the Turkish context. He determined that there were no significant gender differences for the TMT, CMT, and VMT, while a significant gender difference favoring the females was determined for the ACMT. Moreover, he found that the mean values stated for the MEVQ's all subscales by the pre-service female mathematics teachers were more positive than the pre-service male mathematics teachers. The results of research by Durmus and Bıcak (2006) also supported the results given in the current study in that pre-service female mathematics teachers more preferred constructivist values (or connected values) in their future instructions than positivist values (or separated values) did. This result was also observed in the study of Dede's (2009). Vale (2008) also found that affective variables towards mathematics can differ for the genders in other cultures (i.e., New Zealand and Australia). Seah (2007) also determined that the values about effective teaching/learning for both female and male elementary students involved board work, fun, and a combination of teacher experience. However, there were gender differences with values about instruction/explanation and symbolic representation being important for male students and whole-class settings and interest being important for female students. Interviews with two female teachers in the VAMP reveal that they appreciated values such as strength of character, learner differences, small group work, co-operation and association of mathematics with daily life (FitzSimons et al., 2001). Further, it is also found that female teacher conveyed values explicitly, whereas the male teachers would either convey values implicitly or choose not to teach selected values (FitzSimons et al., 2000). Inglehart and Brown (1987) also found that gender alone does not explain differences in achievement motivation when values are controlled.

Limitations and Implications for Future Studies

According to Walshaw (2010), the most important goal of mathematics education in many countries is an enhancement of pedagogical effectiveness. To attain this goal, teachers are important factors to promote egalitarian classrooms and to address long-standing problems of underachieved students. Teachers' values affect their decision making to some degree (Fasheh, 1982). Therefore, as Chin (2006) puts it, it is crucial for teachers to be aware of the values they have and develop an awareness of values and value preferences toward teaching. The present study, in terms of gender and nationality, determined and discussed the values of Turkish and German mathematics teachers. The findings revealed that the mathematics teacher scores in both cultures on mathematics education values were high in general. It is also interesting to note that the female mathematics teachers had higher scores for mathematics education values (for the factor 1 and 2 of the MEVQ) than the males in general. Conversely, it is also interesting to note that German male mathematics teachers had higher mean scores than their German female peers in all possible comparisons. What are the reasons behind these results? How much do culture, curricula, teacher attributes and status, teaching methods, and individual differences affect these results? These questions put forward new study areas for investigators. On the other hand, a aforementioned, this study is limited with the responses given by mathematics teachers in both cultures to items in a Likert -type a questionnaire survey in a natural setting. Further research could involve the conducting of classroom observations and in-depth interviews with the mathematics teachers in both countries in order to examine how the mathematics teachers portray the values in their teaching. Furthermore, this study is also based on data from a small sample. Because of this, it is difficult to generalize the findings from these studies. Further study could examine whether similar results can be obtained from a research based on a larger sample.

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