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Examining the Underlying Values of Turkish and German Mathematics Teachers' Decision Making Processes in Group Studies

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Abstract

The purpose of this study was to explore the values underlying the decision-making processes in group studies for Turkish and German mathematics teachers. This study presented a small part of a wider study investigating German and Turkish mathematics teachers' and their students' values (Values in Mathematics Teaching in Turkey and Germany [VMTG]). The study was conducted with 9 Turkish and 13 German mathematics teachers who were selected with purposeful and theoretical sampling. Semi-structured interviews and field notes were used as data collection instrument. Data were analyzed through constant comparative method. Results revealed four different major categories: (1) productivity, (2) socialization, (3) flexibility/authority, and (4) gender differences. Based on the findings, discussion, further recommendations, and implications were given at the end of the study.

Key Words

Decision-making, Values, Group Study, Turkish Mathematics Teachers, German Mathematics Teachers.

In mathematics education, there exists an increase in the number of publications on affective concepts such as belief, attitude, and emotion in recent years (Grootenboer & Hemmings, 2007). With the inclusion of values in the affective domain components (DeBellis & Goldin, 1997), researches on values in mathematics education have recently begun to appear in the literature, though values have not been a research priority as attitudes (Hannula, 2004). However, these studies have generally remained limited to the determination/identification of culturally western-specific mathematical values (Bishop, 2004). But, it is highly noted in the relevant literature that different cultures come up with different values and even the same mathematical content is taught with different teaching methodologies and approaches (see Seah, 2003b). Thus, lately, research studies on values in mathematics education have come into prominence in other cultures, as well (e.g., Dede, 2009, 2011; Durmuş, 2011; Suharjo, 2007).

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Group Studies in Mathematics Education

Constructivism has been one of the mostly used concepts in education indices in recent years and it presents a psychological perspective on the nature of perception and reality. Constructivism is a learning theory that deals with the way people create meaning and points out a set of learning strategies (Colburn, 2000). It is based on the active and individual construction of knowledge through language and experience and encourages learners

to arrive at his or her version of the meaning by making connections among new learning situations, concept images and prior experiences. It also stresses that learners' social interaction is vital for learning and can be enhanced by sharing, arguing and testing ideas with other learners. In such a social learning process, concepts are constructed by the learner and meaningful learning occurs (Finley, 2000). Group and collaborative learning environments pertain to creating and maintaining such highly social learning environments. Collaborative learning is instructional use of small group activities so that group members work together to maximize their own and each other's learning (Johnson, Johnson, & Smith, 1991). In fact, it is often reported that learning in small group learning environments produces better outcomes compared to competitive or individualistic-oriented learning environments (Johnson & Johnson, 1981). In addition, it is stated that these small group learning environments allow learners to present their points of view and voice their values fairly on the common problem they engage in as well as provide a social basis for discussion platforms designed for learners to participate in intense debates and come to an agreed-upon solution (Gregory & Clemen, 1994). In this sense, such learning environments enable individuals to reveal their personal values and beliefs and communicate openly. The communication of these beliefs and values helps learners understand those values and beliefs clearly. What is my aim? What information do I have? and Why do I think that a particular choice is a good one? are the common questions frequently asked in these environments. To tell or explain something to someone else typically leads one to deeper and more comprehensive understanding. So a clear understanding of personal values and beliefs is a cornerstone of good decision making. Hence, group and collaborative learning environments can play an active role in the attainment and development of better individual decision-making skills (Clemen & Hampton, 1994; Gregory & Clemen). Moreover, group and collaborative learning environments can provide a perfect arena for the understanding of principles and processes related to decision-making context whereas decision-making process can offer a solid basis for the attaining and maintaining essential democratic and social skills in group and collaborative learning environments (Clemen & Hampton). Consequently, group studies are encouraged and the establishment of learning environments suitable for group studies are suggested in all education systems (e.g., see Rahmenplan Grundschule Mathematik [RGM], 2004).

Decision-Making and Teachers' Decision Making Processes

Decision-making is defined as the process of choosing out of alternative courses of action that is dealt with. In the Psychology literature, decision-making and problem-solving are frequently used together and even interchangeably by curriculum makers although these two concepts have different definitions (Beyth-Marom, Fischhoff, Jacobs-Quadrel, & Furby, 1991). For this reason, decision-making is also defined as the selection of the most suitable one course of action out of many possible alternatives for the solution of the problem or difficulty (Aydın, 1989). Gregory and Clemen (1994) summarize eight steps that are elements of good decision-making as follows: defining the problem and establishing the decision context; identifying values; understanding uncertainty; structuring consequences; quality of information; creating alternatives; making tradeoffs; and group negotiations. Beyth-Marom et al. indicate the following steps decision-making process involves: (a) recognizing that a decision must be made in different decision making models (e.g., indefiniteness, risk, and certainty), (b) identifying and defining the decision context, (c) listing the possible options, (d) identifying the consequences that might follow from each option, (e) assessing the likelihood of each consequence, (f) assessing the practicality of each consequence, (g) determining the desirability of each consequence, (h) determining the importance of all this information to decide which choice is the most appealing, and (i) evaluating the whole decision-making process. On the other hand, many different factors may influence decision-making process. These may include cognitive, psychological, cultural, and societal factors. Social and psychological factors refer to those influences from within an individuals' family, peer group, or self (e.g., self-respect, locus of control) while cultural and societal factors include religious beliefs, socio-economic conditions, and ethnicity which influence individuals' decisions. Cognitive factors refer to the mental processes of reasoning and perception. These decision-making processes mature with age and experience and differ in terms of an individual's brain development and acquisition of knowledge (Gordon, 1996).

Unlike many individuals, teachers must make dozens of decisions daily since their work exposes them to rich and complicated situations. However, rather than being explicit and planned, most of these decisions are implicit and arbitrary (Kuo, 2004). Ac-

cording to Bishop (2008), decision-making lies at the heart of instructional processes; therefore, various models concerning teachers' decision-making processes have been suggested (see Bishop & Whitfield, 1972; Davies, 2004; Shavelson & Stern, 1981).

Values and Teachers' Values

Value-free culture and value-free education concepts have been of particular interest until the latter half of the 20th century. Throughout this period, positive beliefs that were free from any particular social value system and formed by technological advancements and scientific explorations based on objective, rational and empirical criteria made their presence felt and the importance of moral factors were neglected. Similarly, social changes were evaluated in the lights of technological advancements rather than consequences and impacts of moral choices of social agents. Yet, this ongoing trend in thought gradually changed with the educational and socio-cultural changes and started to include value indicators (Lee, 2001). Today, the word "value" is used in different contexts for different meanings. For instance, the value of listening to a talk, the ethical value of an individual, and the value of the unknown in an equation, all have different meanings (Seah & Bishop, 2000). Swadener and Soedjadi (1988) assert that some concepts such as "good" and "bad" were needed to identify values as a concept. Raths, Harmin, and Simon (1987) define values as a general guide for the behaviors emerging from people's relations in the real life and their experiences. Accordingly, values are an integral part of human being and they play intentional or unintentional roles on individuals' behaviors, decisions and choices (FitzSimons, Bishop, Seah, & Clarkson, 2001). For this reason, values are influential on teachers' decisions and behaviors (Fasheh, 1982). Gudmunsdottir (1991) regards values as a guide for teacher practice and Matthews (2001) sees them as the tools and the premises of the behavior. Clarkson (2007) states that learners observed teachers' behaviors attentively, recognized their values and behaved accordingly. Frade and Machado (2008) report that values of teachers have a powerful effect on students' attitudes towards mathematics, beliefs, and emotions. On the other hand, values are also handled as personal preferences and decisions associated with individual standards set for behaviors and options that seem important and valuable (Chin & Lin, 2001; Seah, 2002; Swadener & Soedjadi, 1988). Accordingly, values can be perceived as pedagogical identities of teachers as well as choices and judgments they see important or valuable according to their own pedagogical identities (Chin & Lin, 2000).

Mathematics Education, Culture and Values

Mathematics is generally seen as an abstract, cold and inhuman subject in the large societies, so it is associated with the views of absolutist philosophers on the one hand. On the other hand, without rejecting the role of mathematical structure, fallibist philosophers assert that mathematics is value-laden and culture laden (Bishop, 2002; Ernest, 2007). Hence, these two different points of view related to mathematical philosophy typically have different effects on classroom practices (Ernest, 1991) and teachers' values affect teaching approaches they adopt (see Seah, 2003a). In this respect, it is important to determine teachers' value preferences for their instructions and to reveal their awareness on values they have (Chin, 2006). Culture stands as a powerful determiner of mathematical values and different cultures possess different values (Seah, 2003b). There is no consensus about the definition of the concept "culture". However, many people have a general understanding of what culture is and what it requires. In this sense, culture consists of values, beliefs, and concepts shared within a society (Venaik & Brewer, 2008). In the study of Kroeber and Kluckhohn (1952), one of the classical sources, it was noted that traditional concepts (e.g., concepts derived and selected in a historical process) and related values generate the essence of culture. Therefore, mathematics teachers who work in different cultures do not teach the same values to their students, even if they have taught the same curriculum (Bishop, Clarkson, FitzSimons, & Seah, 2000). For example, the value of "technology" may be an important value in mathematics education within an education system while it may not be important at all within another education system (Atweh & Seah, 2008). For this reason, National Council of Teachers of Mathematics [NCTM] (2000) regards mathematics as a part of the cultural heritage and saw it as one of the most important cultural and intellectual accomplishments of human brain. Prediger (2001) characterizes mathematics as a "cultural phenomenon" (p. 23). In a similar vein, in German Primary Mathematics Program (RGM, 2004), it is noted that mathematical concepts and methods are developed in a historical process in line with the problems of social and practical circumstances and teachers are required to teach by considering these individual, societal, and cultural events.

Value Categories

In this study, three value theories developed for the analysis of values will be elaborated and they will be used as the baseline to discuss the findings of the present study. The first two theories involve the classification of the values specifically taught in mathematics lessons (Bishop, 1988, 1996; Lim & Ernest, 1997) whereas the third theory offers a general classification in relation to cultural values (Hofstede, 1980, 2009).

Lim and Ernest's Categorization of Values Taught in Mathematics Lessons: Lim and Ernest (1997) classified the values taught in mathematics lessons as follows: Epistemological Values: They are the values which are about theoretical side of teaching and learning mathematics as well as the characteristics, objectives, and appreciation of mathematical knowledge. For example, systematicity, rationality, and accuracy etc. Social and Cultural Values: They are the values that indicate human's responsibilities about mathematics education for society. Such as, co-operation, justice, honesty, gratitude, modesty, compassion, etc. Personal Values: They are the values that affect person as an individual or a learner. Such as, patience, trust, thriftiness, curiosity, and creativity, etc.

Bishop's Categorization of Mathematical Values: Bishop (1988, 1996), classifies values taught in mathematics lessons into three main categories. These are general educational values, mathematical values and mathematics educational values. General Educational Values are the values which were produced out of general educational and socialization demands of the society (e.g., integrity, honesty, obedience, kindness, etc.) Mathematical Values are the values that reflect the scientific nature of mathematical knowledge (especially with the contributions of Western mathematicians). Mathematics Educational Values are the values related to the norms and practices emerged from teaching and learning mathematics (Atweh & Seah, 2008; Seah & Bishop, 1999). The subcategories of mathematical values are the following: Rationalism- objectivism, control- progress, openness-mystery (see Clarkson, FitzSimons, Bishop, Seah, 2000). Although Bishop (1988) proposes three complementary couples of value (rationalism-objectivism, control-progress, openness-mystery) for mathematical values, he did not exemplify or classify any values for mathematics educational values, implying that pedagogical approaches for mathematics education may differ within and across cultures (Seah, 2011a). To illustrate, the findings of Seah, Bishop, FitzSimons, and Clarkson (2001) show that mathematics teachers in Melbourne have mathematics educational values such as effective work, flexibility, effective organization, persistency, creativity, etc.

On the other hand, Bishop (1988) emphasizes the need to consider the socio-cultural dimension of mathematics education when the development of values related to mathematical thinking is investigated. He also expresses that the socio-cultural dimension of mathematics education affects values of mathematical thinking at five levels. These levels are cultural level societal level, institutional level, pedagogical level, and individual level. Cultural level deals with the relationships between historical/cultural content of the society and mathematics education while societal level handles interactions and social norms affecting mathematics education in schools/classrooms. Institutional level addresses the relationships between the common institutions of the society and mathematics education whereas pedagogical level examines the social interactions (student-student, teacher-student, etc.) in mathematics lessons. Lastly, individual level concerns the mathematics students on an individual basis both in and outside the classroom.

Hofstede's Categorization of Cultural Values: Hofstede (2009) conducts a survey with 117.000 personnel of a multinational corporation (IBM) drawn from more than 70 countries between 1967 and 1973. The purpose of this survey is to reveal differences in values across cultures and determine the effects of value preferences on social behaviors of people. At the end of the study, it is concluded that cultural values differ across nations and these different values in different national cultures could be explained in the following five dimensions (the 5th dimension is developed later with Michael Bond) (Hofstede, 2009). These dimensions are power distance index, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance index, long term orientation vs. short term orientation (see also Cooper, Calloway-Thomas, and Simonds (2007) for relationships between Hofstede's cultural values and teaching environments).

The Purpose and Significance of the Study

International comparative studies help to determine how students learn mathematics and make decisions accordingly as well as to find out the problems in teaching and learning mathematics within the countries that are compared (Cai, 2006). In addition, mathematics education in dif-

ferent countries is strongly affected by social and cultural factors that shape beliefs, aims, teaching methodologies and expectations. Different cultures and societies follow different philosophies for teaching and learning mathematics. The variety in values and beliefs regarding mathematics education leads to diversity in education systems across countries (An, Kulm, Wu, Ma, & Wang, 2006). In this respect, the purpose of the current study is to examine the underlying values of Turkish and German Mathematics teachers' decision making processes for the problems/situations they encounter in a learning environment. For this purpose, the study tries to determine what underlying values affect teachers' decisions while forming groups when a group study is planned to teach any subject in a mathematics lesson. As a matter of fact, group and collaborative learning environments can contribute to the attainment and development of better individual decision-making skills (Clemen & Hampton, 1994; Gregory & Clemen, 1994) and such environments can ease the understanding of principles and processes related to decision-making context (Clemen & Hampton).

In mathematics education, there exist articles and projects that note the place and importance of values in the literature (e.g., Dede, 2009, 2011; Values in Mathematics Teaching [VIMT]) and Values and Mathematics Project [VAMP], etc.). However, no study that investigates the underlying values of teachers' decisions for the problems/situations they encounter in a learning environment is encountered in the literature. Nonetheless, a limited number of studies that examine values that lie behind effective mathematics teaching according to the views of students and teachers appear in the literature (see Seah, 2011b). Consequently, it is essential to uncover the underlying values of mathematics teachers in culturally, socially and educationally different countries such as German and Turkey and their decision making processes as well as the factors that affect these values. As mentioned before, different cultures have different values and even the same mathematical content is taught with different teaching methodologies and approaches in different cultures (Seah, 2003b) and values affect teachers' preferences, behaviors (Yero, 2002) and decisions (Fasheh, 1982). Hence, if teachers' values are recognized, the reasons behind their classroom practices, preferences, decisions, and behaviors can be understood better. That is why, this study reports only some parts of the findings of a wide range project (Values in Mathematics Teaching in Turkey and Germany -VMTG) which analyses mathematical values of Turkish and German mathematic teachers and students, and specifically seeks answers to the question below:

What are the underlying values of Turkish and German teachers' decision making processes during classroom practices (formation of groups)?

Method

Research Design

This paper is based on the findings of VMTG project. Briefly, the purpose of VMTG project was to determine the values of Turkish and German teachers and students. VTMG project adopted sequential mixed method research design in which quantitative and qualitative research methods were used together. Quantitative methods helped to make statistical deductions and interpretations with regard to the relations between concepts while qualitative methods enabled flexibility and ensured to acquire in-depth information about the concepts investigated in the research (Punch, 1998). Depending on the aims and characteristics of phases of VMTG project, this study employed a wide range of sampling methods together. It made use of convenience and purposeful sampling methods for quantitative data and purposeful and theoretical sampling methods for qualitative data. The reasons behind the use of sequential mixed method research design are as follows: (a) sequential mixed method is a research design that compensate for the limitations of one research method by the strengths of another research method to increase the reliability of the findings (Rudestam & Newton, 2007) and (b) in this study, since progress is the aim of sequential mixed method, the use of sequential mixed method is appropriate. This is because progress includes the sequential use of method in such a way that the findings of the former research method set ground for the use of the latter research design (Onwuegbuzie & Collins, 2007). In the VMTG project, the first phase of this method was the quantitative data collection (with the use of a Likert-type scale) and analysis. In the second phase, based on the findings of the quantitative data, qualitative data were gathered (by the means of semi-structured interviews, classroom observations, document analysis, the open-ended question form and field notes, etc.) and analyzed. In this way, quantitative data and findings were used to produce necessary content for the qualitative data and analyses, so that the analysis of quantitative data were integrated with the qualitative data analysis. However, the pres-

ent study made use of only the findings collected through semi-structured interviews and field notes. Besides, it was delimited to the reports of some parts of data gathered via qualitative research methods (the investigation of the underlying values of teachers' decision making processes during group formation in a group study).

The mathematics program includes both explicit and implicit values. Implicit values are presented in a hidden manner, acquired in more subtle ways, and evidenced in the learner's behavior. The explicit values are planned explicitly, applied in the classrooms, and acquired from the instruction. In the current study, explicit values were determined through the semi-structured interviews made with teachers. Implicit values can be spotted by the qualitative data like classroom observations that help to make interpretations and deductions about the phenomenon and concept investigated in the study (Dede, 2011). Therefore, the definition of value used in the present study to ascertain the explicit values is statements are of importance and worthwhile for the individual as personal preferences (Chin & Lin, 2001; Seah, 2002; Swadener & Soedjadi, 1988) as well as "principles, fundamental convictions, ideals, standards or life stances which act as general guides to behavior or as points of reference in decision-making" (Halstead, 1996, p. 5).

Participants

The participants of the study were 13 German and 9 Turkish mathematics teachers. All German teachers work at primary and secondary schools in a province in northern Germany. Turkish teachers, on the other hand, work at primary and secondary schools in two provinces in Central Anatolia Region. For the selection of the provinces, their representability was considered in terms of country characteristics. All of German teachers have the authority to teach mathematics until the 9th grade and 6 of them are also authorized to teach mathematics until the 13th grade. As for Turkish teachers, 4 teachers have the authority to teach mathematics until 12th grade and 5 teachers have the authority to teach mathematics until 8th grade. In Turkey, primary education was compulsory and lasted for 8 years. Secondary education lasted for 4 years. However, in the year of 2012 (March, 30), education system in Turkey was radically reconstructed. With this reconstructed system, compulsory education in Turkey is 12 years and elementary education is 4 years while secondary education (secondary level I is 4 years and secondary level II is 4 years) is 8 years. It will be applied in 2012- 2013 education year. Elementary and secondary education in Germany differ according to the states. Elementary education is 6 years while secondary education (secondary level I is 4 years and secondary level II is 2- 3 years) is 6- 7 years in Berlin. Of the German and Turkish teachers, one teacher serves as a leader in their schools or school districts and attends in-service training programs as a trainer. 2 German teachers holds MS degree in mathematics education and 1 teacher has PhD degree in theology. On the other hand, 2 Turkish teachers hold MS degree in educational sciences. Length of service of the German teachers ranges from 1 year to 35 years while Turkish teachers have 4-30 years of service. Among German mathematics teachers, females outnumber males. As for Turkish teachers, the case is just the contrary. Since female teachers generally avoid participating in classroom observations of the study, male Turkish mathematics teachers are high in number. Furthermore, of the Turkish teachers, two out of three were graduated from the Department of Mathematics Educations in Education Faculties that were partially re-established based on the constructivist approach in 1997. Because about the year 2000, teacher education in Germany is radially re-constructed according to the Bologna Reform agreement, most of the German teachers surveyed in current study have passed through the old Staatsexamen system (according to their level of teaching experience).

In the present study, purposeful and theoretical sampling methods were used together. Maximum variation sampling method out of purposeful sampling methods was employed. Patton (1990) summarizes the aim of the purposeful sampling as "selecting information-rich cases for study in depth" (p. 169) and states that maximum variation sampling aimed for "capturing and describing the central themes or principal outcomes that cut across a great deal of participant or program variation" (p. 172). Theoretical sampling shows the repetitive process of data in qualitative studies. This sampling method interprets the theory/theories under investigation using the data gathered from a new sample and stands as the most suitable method for grounded theoretical approach (Marschall, 1996). Sampling ceased "when 'theoretical saturation' is reached, that is, when no new analytical insights are forthcoming from a given situation" (Arber, 1993, p. 74).

Data Collection Instruments and Procedure

As mentioned before, although different data collection instruments were used in the framework of VMTG project, the current study focused on only some parts of the findings of VMTG project (the investigation of the underlying values of teachers' decision making processes during group formation in group studies). Hence, only the data collected through semi-structured interviews and field notes were analyzed.

Semi-Structured Interviews

Preparation of Interview Protocol: Within the scope of VMTG project, a detailed protocol was prepared by the researcher to determine the values of mathematics teachers. This protocol was sent to the three experts with PhD degree in mathematics education, science education, and educational sciences to get their opinions. It was presented to faculty members with expertise in different disciplines because the concept "value" has a multidimensional nature and involves multidiscipline. These experts are qualified especially in qualitative researches. In addition, the expert in educational sciences holds the PhD degree in values education. The interview protocol were revised and finalized in the light of the expert feedback. The finalized protocol includes a wide range of questions and statements from theoretical knowledge to classroom practices. However, this study examines only one classroom practice of mathematics teachers. It investigates the underlying values of mathematics teachers' decision-making processes during group formation in group studies. Some of the basic questions added in the interview are the following:

* Which one is important to you- group study or individual study?

* Suppose that you would like to do group work. But, some students protest against with the demand of individual learning. What would you do in such a situation?

* Suppose that you would like to do group work. But, some students protest against and want to form a group only with students of the same gender. What would you do in such a situation?

Interview Procedure: Interviews were carried out with 22 mathematics teachers in total from both countries. Real names of the participants were not used for the sake of confidentiality and reliability. Turkish teachers were coded as T1, T2,… while German teachers were coded as G1, G2,… At the very beginning of the interviews, each teacher was informed about the aim of the research and interview as well as how and where the data would be used. Throughout the interviews, principles of clinical interview method (Gingsburg, 1981) was followed with the use of such expressions as "why?", "explain", "how?" and views of the interviewees were obtained in detail. Clinical interviews set ground for explicit strategies, activities, and circumstances that are suitable to individuals' knowledge and thoughts about any phenomenon (Hunting, 1997). During the interviews, the teachers were asked one question at a time and they were required to explain their views and opinions about the question. Depending on the responses of the teachers, new or modified questions were also utilized in order to uncover the real knowledge and opinions of the teachers. Since the number and variety of the questions changed according to the teachers, the duration of the interviews ranged from 50 to 116 minutes. Interviews were conducted in warm and calm places in the schools where the teachers work. During the interviews, teachers were encouraged to think and answer in comfort and peace. With the consent of the participants, the interviews were recorded. Only one German female teacher did not allow for recording, so the interviewer wrote down her interview. Besides, a Turkish student who knows both Turkish and German well and study at the department of educational sciences in a German university accompanied the researchers during the interviews to help if needed.

Semi-Structured Interview Translations: Interviews were carried out in mother tongue of the participants- in Turkish with Turkish teachers and in German with German teachers. In this way, all teachers were encouraged to express their views in relation to the research topic without experiencing any language problems. Firstly, the interviews of German teachers were translated into Turkish by the researcher. Then, the same interviews were also translated into Turkish by the aforementioned student separately. Lastly, a Turkish teacher who teaches at a primary school in Germany and knows both Turkish and German well translated these interviews independently, as well. This teacher graduated from the department of German Language and Literature both in Turkey and Germany. Finally, all these translations were compared and finalized.

Field notes

Field notes is an important step for data analysis and for example; "it used to record non-verbal

aspects of the interview …" (Hoffmann, 2004, p. 57). Similarly, Sowden and Keeves (1988) also described "… field notes can contain reflective remarks that arise from watching a situation or talking to people linked to the evaluator or the client" (p. 518). Therefore, in this study, field notes were written to summarize the behaviors and manners of the teachers during the interview for every mathematics teacher after the interviews (see Findings Section).

Data Analysis

Semi-structured interviews with teachers were analyzed through making use of constant comparative method (CCT). The analysis of the data collected in the study was continued until the saturation was reached (Arber, 1993). The types of "comparison of interviews from groups with different perspectives but involved with the subject under study" (Boeije, 2002, p. 396) of CCT was used. CCT consist of three phases; open coding, axial coding, and selective coding (Glaser & Strauss, 1967; Strauss & Corbin, 1998). Open coding is realized with starting category of the information on the phenomenon under investigation, and segment information (Creswell, 2008). With this way, the meaning and thinking of the concepts are revealed, and units are identified oriented on text and the topic of the research. After that, these units are divided into categories and sub-categories. In the step of axial coding, categories and sub-categories were established for the certain and complementary explanations regarding the phenomenon under investigation. In the step of selective coding, the relationship of categories with sub-categories and further with other data is sought (Pitney & Parker, 2002).

In this study, at the end of the open coding phase, 62 open coding for Turkish teachers and 56 open coding for German teachers were obtained. In the phase of axial coding, major and sub-categories were formed; as a result, 7 axial coding for Turkish teachers and 10 axial coding for German teachers were created. In the phase of selective coding, it was especially considered that the teachers from both countries gave common responses at least at the rate of 70% to each one of the categories. Yet, only one Turkish teacher expressed an appropriate opinion with regard to the 4th category (gender differences), so this category was formed mostly in line with the opinions of the German teachers. Some coding samples are presented in Table 1:

Table 1.
Coding Samples

Phases of Coding	Coding Sample	Description
Open Coding	Instructional objective-oriented values	Organization, planning, objective achievement, expediency, interactive learning, optimum outcome
Axial Coding	Instructional objective-oriented values	Student-oriented values Instructional objective-oriented values
Selective Coding	Productivity	Instruction environment-oriented values, Values emerged from country differences (cultural, societal, educational, etc.)

Trustworthiness of the Study

According to Denzin (1998), triangulation is the "application and combination of several research methodologies in the study of the same phenomenon" (p. 511). In the study, research data were collected through semi-structured interviews and field notes for the purpose of triangulation. In fact, quantitative research studies on values may lead to subjective and controversial understanding owing to the nature of values; consequently, studies on values in mathematics education generally prefer qualitative research methods. The validity and reliability of qualitative research methods is ensured with data triangulation (Seah, 2008). Additionally, the categories formed in this study were compared with Lim and Ernest's (1997) category of values taught in mathematics lessons, Bishop's (1996) category of mathematical values, and Hofstede's (2009) category of cultural values so that "theoretical triangulation" (Cohen, Manion, & Morrison, 2000, p. 113) was performed on the categories. In order to categorize the data gathered from various sources and to identify common expressions, interview transcripts and field notes were read several times. Teachers' expressions were transcribed without any changes and these verbatim transcripts were submitted to the approval of the teachers, which provided "member check" (Creswell, 1998) for the reliability of the interview data. "Peer review" was also applied for the reliability of the research

data. According to Lincoln and Guba (1985), peer review is a kind of external control mechanism for the research reliability. Thus, major and sub-categories created by the researcher were sent to two separate researchers, one of whom has a PhD degree in mathematics education and the other holds a PhD degree in science education. In the light of expert opinions, sub-categories were modified. For example, the researcher placed the value "respect/care student" either in the category of "flexibility/authority" or as a separate category. However, the expert in mathematics education suggested that this value should be placed as a sub-category in the category of "flexibility/authority" by emphasizing the expression way of teachers' opinions. As a result, the researcher placed the aforementioned value in this category. Once all the categories were examined, the concordance correlation coefficient between the researcher and experts in mathematics education and science education were calculated as 0.90 and 0.86 respectively.

Findings

After data analysis, a total of four categories of values emerges. These categories are productivity, socialization, flexibility/authority, and gender differences. These categories of values are explained in detail below:

Productivity

In this study, the following definitions in relation to this category were taken into account: (1) "outcome, yield, performance of something that are operated, run or raised (Türk Dil Kurumu/Turkish Language Institute [TDK], (1998, p. 2342); (2) "Produkte hervorbringend" WAHRIG Deutsches Wörterbuch [WDW], 2006, p. 1169). The opinions of both Turkish teachers and German teachers regarding the category of productivity fell under the two sub-categories "student-oriented and instructional objective-oriented values". But, the values in these sub-categories differed according to the countries. For Turkish mathematics teachers, student-oriented values were motivation, awarding, willing to study, good comprehension, effective learning, able to succeed, neatness, and focus on study whereas instructional objective-oriented values were objective achievement, expediency, and economy. As for German teachers, student-oriented value was only deep understanding while instructional objective-oriented values were organization, planning, interactive learning and optimum outcome formation.

Herein, Turkish mathematics teachers (11 open coding) stress the category of productivity more than their German colleagues (5 open coding). To exemplify, T3 works at a primary school and has a 7-year-teaching experience. T3 emphasized the student-oriented values and indicated the importance of respecting student and guiding students to study. In this case, it can be argued that the underlying values of T3's decision making process in forming study groups were the student-oriented values "focus on study" and "able to succeed" in the category of productivity. Moreover, it can be stated that the value "respect/care student" was important to T3. On the other hand, G6 works at a secondary school (Gymnasium) as a mathematics teacher and has a 13-year-teaching experience. Her/his second major is physics. S/he is authorized to teach mathematics and physics until the 10th grade. During the interview, G6 had an intimate and friendly attitude and voiced her/his views openly. Within T3's decision making process during forming study groups, the underlying value was ascertained as instructional objective-oriented value "optimum outcome formation". Furthermore, in this process, the value "collaboration" was also an important value for G6.

Socialization

This study defines socialization through the following definitions of WDW (2006) "allmähliches Hineinwachsen des Menschen in die Gesellschaft" (p. 1377) and TDK (1998) "to educate to behave according to the society norms" (p. 2015). Thus, the category of socialization can be regarded as societal values, as well. For both groups of teachers, societal values play almost equally effective role in their decision making processes in group studies (10 open coding for Turkish teachers and 9 open coding for German teachers). Nonetheless, it is important to note that societal values differed according to the countries. For Turkish teachers, societal values included collaboration, idea exchange, discussion, cooperation, sharing, partnership, integration, socialization, adaptation, and loving. For German teachers, collaboration, responsibility, cooperation, sharing, teamwork, respect, broadmindedness, dialogue, and consensus constituted societal values. Herein, cooperation, sharing, and collaboration were the common values for the both groups. For example, T4 works at a primary school as a mathematics teacher. S/he has 27 years of teaching and 20 years of administration. During the interview, T4 behaved in a confident, mature, calm and authoritarian manner and expressed her/his opinions

openly and resolutely thanks to her/his long years of teaching and administration experience. The underlying values of T4's decision-making process during group formation were determined as "sharing", "cooperation", "collaboration", and "integration". G5, on the other hand, has been a mathematics teacher for 10 years and works at a secondary school (Gymnasium). Her/his second major is German. S/he has taught mathematics at different levels from primary education to tertiary education. Throughout the interview, her/his familiarity with the vision and principles of mathematics curricula at all levels was observed. The underlying values of G5's decision-making process during group formation were designated as "consensus", "cooperation", and "collaboration". Some part of the interview made with G5 is given below:

> *M: Suppose that you would like to do group work. But, some students protest against with the demand of individual learning. What would you do in such a situation?*
>
> *G5: I do a lot of group studies. In our school, we teach a 3-day-course in the 7th grade. In this course, we show how group studies can be conducted effectively. We search for consensus in the group … In all classes at the school; this kind of group study systematic exists. And, group studies are a way of teaching that can be easily performed by every teacher. It is also important for students to contact with other students they do not know well so that they can experience the feelings of cooperation and teamwork.*

Flexibility/Authority

In this study, the definitions of TDK (1998) "retain the power, establish or obtain power" (p. 1705) and WDW (2006) "maßgebender Einfluss" (p. 216) were acknowledged for the concept "authority". Similarly, the study defines "flexibility" in terms of the definitions of TDK "susceptible to different interpretations" (p. 730) and WDW "veränderlich (Vorschrift)" (p. 530).

Concerning the value "flexibility", teachers' views change depending on the country. With regard to this category, the views of Turkish teachers were gathered in the sub-categories of respect student and consider the conditions while German teachers expressed only consider the conditions in this category. Nevertheless, the category "consider the conditions" differs according to the countries. Accordingly, the underlying values of Turkish mathematics teachers' decision making processes were specified as personality of student(s), the number of students, and content of subject matter of concern. On the other hand, class level, reactions of group members, impact of group members on other groups, assignment/task to be assigned, characteristics of student(s) (age, capability, personality, relations, and performance), content of subject matter, time, and experience were the prominent factors for German mathematics teachers. In the process of forming groups, Turkish teachers paid attention to gender distribution across groups (see the 4th category) and\Turkish teachers stressed the value "respect/care student". However, regarding gender distribution across groups, German teachers use their authority. Within the context of "respect", Turkish teachers featured the values "value/care" and "democratic demand". In this study, to define the concept "respect", the definitions of TDK (1998) and WDW (2006), which are respectively "feelings of love, regard, reverence to behave in a cautious, attentive, and moderate manner towards somebody/something due to their value, virtue, age, utility, and sanctity" (p. 1922) and "Achtung, …" (p. 122)". A sample of interview illustrating the value "flexibility" is presented:

T8 works at a primary school and has 7 years of teaching experience. S/he is a researcher who has a MS degree in educational sciences. The value "democratic demand" came into prominence as the underlying value of her/his decision-making process in group studies. Some parts of the interview made with T8 are as follows:

> *M: Suppose that you would like to do group work. But, some students protest against with the demand of individual learning. What would you do in such a situation?*
>
> *T8: At times, girls protest against the group work. Or some students have different ideologies and life-styles. Morality is important to me. Sometimes, I exclude them from the groups and allow them to work individually and other times I do not.*
>
> *M: What is the reason behind this?*
>
> *T8: All have certain beliefs, life-styles and they have the right to feel comfortable.*

Regarding the value "authority", both groups of teachers expressed views in the direction of absolutism and semi- absolutism. Absolutism means that teacher unconditionally has the authority to control all situations. On the other hand, semi-absolutism implies that teacher has the authority but requires the approval of student in some situations. In order to get approval, Turkish teachers persuade students, explain reasons, and intervene in unfavorable circumstances while German teachers let students set and apply rules, search for mo-

tives, and intervene in unfavorable circumstances. When the interviews and field notes are evaluated holistically, it can be asserted that the value "productivity" lies behind these attitudes. To exemplify the value "authority", some parts of an interview are given below:

Similar to T5, G12 valued absolutism in her/his decision making process in group studies. When G12 were asked whether s/he considered gender differences while forming groups, s/he responded as "I do not tolerate such demands. Students have to learn to study with others, which should be independent from gender."

G10 works at a secondary school (Gymnasium) as a mathematics teacher and has a 12-year-teaching experience. Her/his second major is sports. S/he behaved calmly and determinedly during the interview. In a group study, G10 reported that s/he first searched for the reasons behind students' objection to group formation and decide accordingly. The quotations taken from the interview of G10 is provided below:

> *M: Suppose that you would like to do group work. But, some students protest against with the demand of individual learning. What would you do in such a situation?*
>
> *G10: It depends on the situation and the student. I ask the student "Why don't you want to work in groups?" First, I take the student out of the classroom and try to compromise with her/him. But, if her/his problem cannot be solved,… [taught] it depends on the situation.*

Gender Differences

This category could have been placed in the category of socialization/societal values. Yet, it was handled as an independent category since German mathematics teachers had particular and different attitudes towards gender differences from their Turkish colleagues. In this study, gender was considered in terms of the definitions of TDK (1998) "special biological characteristics which define humans as female or male and attribute different roles to them in progeneration" (p. 411) and WDW (2006) "Überbewertung der geschlechtlichen Unterschiede" (p. 1353).

Regarding the category of gender differences, teachers' views change depending on the country. When Turkish teachers were asked whether they considered gender differences while forming groups, it was observed that all (except for T3) gave priority to the value "productivity" and they did not voice any opinions related to gender differences. As for German teachers, it was found out that most of them (90%) expressed different opinions from their Turkish colleagues and their opinions directly focused on gender differences. The values spoken out by German teachers in relation to this category were esthetics, beauty, neatness, and gender-based collaboration. For instance, G6 said "I pay attention to gender distribution across groups, I form mixed groups. Girls draw, write better in group studies" and, as T3 do, indicated that such values as esthetics, beauty, and neatness belonged to girls.

Discussion

In this section, the underlying values of Turkish and German Mathematics teachers' decision making processes (in group studies) will be discussed in terms of their similarities and differences. While doing this, Lim and Ernest's (1997) category of values taught in mathematics lessons, Bishop's (1996) category of mathematical values, and Hofstede's (1980, 2009) category of cultural values will be taken into account. Also, recommendations for education of mathematics teachers and further studies will be provided.

Similarities and Differences in the Category of Values Taught in Mathematics Lessons

In the end of the present study, the underlying values of the Turkish teachers' decision making processes were categorized under three main headings whereas those of German teachers were categorized under four main headings. The first three values could be handled commonly although their subcategories differ according to the countries. However, it was concluded that the fourth value (gender differences) was more important to German mathematics teachers. Moreover, two of these values (productivity and flexibility/authority) can be considered within the category of values in mathematics education while the other two (socialization and gender differences) can be addressed in the category of societal and cultural values. The values productivity and flexibility/authority were prominent in decision-making processes of both groups of teachers (in group studies). But, when each category was examined in detailed, certain differences were observed in their sub-categories. Within the scope of the definition adopted in this study, it was found out that the value productivity was process and product-oriented and it included two sub-values as student and leaning environment-oriented.

Besides, it was observed that Turkish mathematics teachers put more stress on student-oriented values (willing to study, able to succeed, focus on study) compared to their German colleagues, which shows parallelism to the results of studies conducted with Turkish mathematics teachers (see Dede, 2011; Durmuş & Bıçak, 2006). 11 sub-values offered by Turkish mathematics teachers concerning the value "productivity" and the quotations mentioned above demonstrated that Turkish mathematics teachers care about process and product-oriented values in their decision-making processes related to their classroom practices more than their German colleagues. This can be associated with the re-establishment of Education Faculties in Turkey in 1997 and the modification of the Mathematics Education Program in 2004 according to the principles of the constructivist approach. Turkish Ministry of National Education (Milli Eğitim Bakanlığı [MEB]) (2009a) indicated the importance of process and product-oriented values in this way:

> *In teaching-learning process, both process and product should be assessed. Assessment tools provided in the program supplement can be used as they are, by readjusting or choosing the ones that fit for purpose in the course of process and product oriented assessment (p.10).*

In a similar way, the values organization, planning, interactive learning, and optimum outcome formation in the category of learning-oriented values that were expressed by German mathematics teachers are among the values that should be taught with group studies in the German Mathematics programs (e.g., RMG 2004). When these are considered, it can be argued that the mathematics programs of the countries play an effective role in teachers' decision-making processes. This argument can be handled in the category of "institutional level" affecting values of mathematical thinking within the socio-cultural dimension of mathematics education. In fact, institutional values are influential on programs and textbooks (Clarkson, Bishop, & Seah, 2010). On the other hand, the values effective learning, willing to study, neatness, and focus on study for Turkish teachers and the values organization, planning, interactive learning, and optimum outcome formation for German teachers match up with the values determined by the study conducted with the mathematics teachers in Melbourne (Western culture and multicultural) (Seah et al., 2001). It is clear that these matching values are the student-oriented values for Turkish teachers while they are learning environment-oriented values for German teachers. These findings parallel with the researches that showed mathematics educational values (productivity in particular) may differ across and even within cultures (Western culture) (Bishop et al., 2000; Seah, 2011a). The aforementioned student and learning-oriented values crosses with Bishop's (1996) mathematics educational values. When these findings are examined within the framework of Bishop's (1988) categorization of five levels of the socio-cultural dimension of mathematics education affecting mathematical thinking, student-oriented values can be considered at individual level and learning-oriented values can be considered at pedagogical level. In addition, student-oriented values can be placed in the category of "individual values" suggested by Lim and Ernest (1997) in relation to the values taught in mathematics lessons.

One of the important findings of the present study displays that both Turkish and German mathematics teachers take characteristics of their society and culture (norms, values, etc.) into account while making decisions (see the category of socialization). Hereunder, the values cooperation, sharing, and collaboration were effective in decision making processes of both groups of teachers. Statements with regard to the instruction of these values are available in the mathematics programs of the both countries (see Rahmenlehrplan für die Sekundarstufe 1 [RSS], 2006; MEB, 2009a), which implies that the mathematics programs of the countries affect teachers' decision- making processes. Hence, this inference can be acknowledged in Bishop's (1988) category of values at "institutional level". Moreover, the values broadmindedness, dialogue, and consensus expressed by German teachers in the category of socialization pertain to the multicultural structure of the German society (especially Berlin), which display that German teachers give priority to socio-cultural values in their decision-making processes. The value of socialization can also fall into the category of "social and cultural values" under Lim and Ernest's (1997) categorization of values taught in mathematics lessons.

The current study also shows that the values flexibility and authority affect the both groups of teachers' decision making processes. These values can be put into Lim and Ernest's (1997) category of "personal values", Bishop's (1988) category of "individual values" and Bishops's (1996) category of "mathematics educational values". Herein, it was observed that the value flexibility (see consider the conditions) was more influential in German teachers' decision-making processes than those of their

Turkish colleagues. Yet, it was also reported that German teachers paid more attention to gender difference while forming groups and used their authority more compared to their Turkish colleagues. When the interviews and field notes are considered together, it can be claimed that these two attitudes of German teachers were not in contradiction with each other and the value productivity lies behind their attitudes.

Another important finding of the study demonstrates that gender differences have an effect on teachers' decision-making processes. The value gender differences can be considered in Lim and Ernest's (1997) category of "social and cultural values" and Bishop's (1988) category of values at "societal level". This value can be regarded as the most striking value that explicitly shows the social and cultural differences between the two countries. In the study, it was found that German mathematics teachers paid more attention to this value while making decisions than their Turkish colleagues. They also identified the sub-values esthetics, beauty, and neatness (especially for female students) and gender-based collaboration in the category of gender differences. Here, it can be argued that these values correspond to the values attributed to the women in Western culture. In the theory of gender-based values suggested by Gilligan (1982), the values attributed to the women in Western culture are connections, caring, empathy, feelings and intuition, tends to holistic and human-centered whereas the values attributed to the men are unfeelingness, objectification, abstraction, impersonality, dispassionate reason and analysis, and tends to be atomistic. Thus, it is understandable that German teachers identified the values esthetics, beauty, and neatness as the values attributed to the women. The mathematics programs affected by the values at "institutional level" as Bishop (1998) indicated also support this identification. To illustrate, the German secondary mathematics program (Rahmenlehrplan für die Gymnasiale Oberstufe [RGO], 2006) emphasizes this as follows:

> *In lessons, learning environments in which students with different gender work together promote students' understanding and awareness of self and the opposite gender' learning. They support the phenomenon of living with the opposite gender in life. They also encourage students to make independent decisions for their personal and professional lives from the socially and traditionally attributed roles (p. 7).*

On the other hand, when Turkish teachers were asked whether they considered gender differences while forming groups, it was observed that all (except for T3) gave priority to the value "productivity" and they did not voice any opinions related to gender differences. However, it is obvious in the following statements that MEB (2009b) attach great importance to the gender distribution across groups: "Teachers should form heterogeneous groups in terms of students' gender, academic achievement, etc. in group projects" (p.107) and " In collaborative learning, teachers should form homogenous and heterogeneous groups by taking students' achievement levels, genders, personality characteristics into account" (p. 25). The reasons lie behind the importance Turkish teachers attach to the value productivity are explicable. In Turkey, the Turkish education system is based on large scale centralized exams (Yıldırım, 2008) and the success or failure of Turkish teachers is determined by the means of these exam results at both institutional and societal levels. With this, it can be concluded that societal and institutional values are effective on Turkish mathematics teachers' classroom practices (group formation) (Bishop, 1988; Lim & Ernest, 1997).

Similarities and Differences in the Category of Values in Mathematics Education

When the underlying values of the mathematics teachers' decision-making processes during classroom practices are examined in the framework of Hofstede's Category of Cultural Values (1980), interesting and striking findings appear to stand out. In Hofstede's (1980) study, it was concluded that the Turkish society has a high power distance index and high levels of uncertainty avoidance index. It was also found that the Turkish society has a collectivist view and it is shaped by the female-specific values. Accordingly, as Cooper et al. (2007) stated, the reflections of these values on classroom practices are expected to lead to teacher-centered instruction and result in such a perception that it is disrespectful to question teachers' presentation/decision. However, the findings of this study prove the opposite. For example, it was found that Turkish mathematics teachers attached great importance to student-oriented values (see the value productivity) in their decision making processes and they respected their students' demands even if they contracted with their own decisions (see the value flexibility), which may be attributed to the modification of mathematics programs based on the constructivist approach. Nonetheless, further studies are needed to reveal whether these values are observed in Turkish teachers' classroom prac-

tices. It is also needed to test the validity and up-to-dateness of Hofstede's category of cultural values in Turkish society since Turkey has been undergoing major developments and changes in recent years.

On the other hand, in Hofstede's (1980) study, it was ascertained that the German society has low power distance index and low level of long term orientation, but high levels of uncertainty avoidance index. It was also concluded that the German society has an individualist view and it is shaped by the male-specific values. In accordance with these findings, the reflections of these values on classroom practices are expected to lead to student-centered instruction and innovativeness (Cooper et al., 2007). Yet, in this study, it was found that learning environment-oriented values are more influential on German mathematics teachers' decision making processes (in group formation) than student-oriented values (see the value productivity). Furthermore, in this study, it was determined that the value gender differences (e.g., esthetics, beauty, and neatness) have an effective role in German mathematics teachers' decision-making processes. So, it can be asserted that this value pertain to Hofstede's (1980) category of masculinity- femininity. The German society is a masculine society (Hofstede, 1980) and female-specific values in traditional western societies are modesty, empathy, esthetics, and beauty, etc. (Gilligan, 1982). In the current study, it was concluded that German teachers acknowledged the traditional roles attributed to the women (e.g., esthetics, beauty, calligraphy) in western societies; and in the meantime, they could use their authority to assure the collaboration among genders. Intimacy and collaboration of students with different genders is already encouraged in German mathematics programs (RGO, 2006) as "[…make independent decisions from the socially and traditionally attributed roles (p. 7).

Implications for Mathematics Education and Further Study

Teachers often must make dozens of decisions in learning environments, and decision-making is one of the cornerstones of good teaching-learning process, so the more knowledge related to how teachers make decisions is gained, the more concrete prescience can be realized for their instruction (Bishop, 2008). And it is common knowledge that values of teachers affect their decisions to some extent (Bishop & Whitfield, 1972; Bishop, Clarkson, FitzSimons, & Seah, 2001; Fasheh 1982). Values of teachers also direct their classroom practices and play an active role in determining school goals and objectives, programs and teaching methods (Yero, 2002). Thus, it is quite essential for teachers to be aware of their values and preferences of instruction and work to improve them (Chin, 2006). In this sense, this study enables mathematics teachers to raise awareness on the underlying values in their decision making processes during classroom practices, to understand the importance of cultural, social, and individual values affecting their values and to revise their preferences if necessary.

The findings of the present study show that mathematics programs and institutional values (Bishop, 1988) play an important role in mathematics teachers' decisions on classroom practices. Hence, it is necessary for curriculum makers and textbook writers to take the institutional values suggested by Bishop into consideration. Another finding of this study conducted with two groups of teachers possessing different cultural, social, and personal values indicates that cultural, social, and personal values are influential on mathematics education (Sam, 2003). This finding also mirrors the research findings proving that different cultures carry different values (Bishop et al., 2000). To exemplify, social (e.g., the emphasis on the value productivity in the category of gender differences), personal (e.g., flexibility/authority), and institutional values (e.g., exams, programs) are effective in Turkish teachers' decision making processes.

This study also demonstrates that Turkish teachers' classroom practices show differences (e.g., student-centered values) in terms of the application of Hofstede's category of cultural values (1980) to classroom practices (Cooper et al., 2007). The investigation of the reasons behind these differences stands out as another research topic. Similarly, another further study can examine the value "gender differences" affecting German teachers' decisions in terms of traditional roles attributed to the women in the Western culture.

The present study, as mentioned before, is delimited to the investigation of the underlying values of teachers' decision making processes during just one classroom practice (group formation in one group work activity) through interviews and field notes. Consequently, it may be significant to examine the decision-making processes of these teachers from different culture and society during different teaching-learning contents and practices. In this way, in-depth knowledge about the values affecting teachers' decisions can be acquired and the teaching-learning process can be enriched (Bishop,

2008). In addition, further qualitative studies can be carried out with classroom observations so as to find out whether the values reported by the teachers on are reflected on their classroom practices.

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