Chapter 20
Turkish High School Students' Mathematics Values in Terms of Feelings About Mathematics

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20.1 Introduction

Although the future is difficult to predict, we can adapt by keeping up with some popular trends today, learning to develop and even shape the future, and helping our children learn. Here, we must develop not only students' knowledge and skills but also their attitudes and values that can lead them to ethical and responsible actions (The Organization for Economic Co-operation and Development [OECD], 2022). In this sense, the OECD Learning Compass 2030 report proposed a very conceptual and helpful framework that defines the knowledge, skills, and values (and attitudes) that learners need to fulfill their potential and contribute to the well-being of their societies, cultures and the world (OECD, 2019).

Here, the well-being of communities in general, and individuals in particular, depends on the practical characteristics of the speaker's environment at the time of the judgment (Alexandrova, 2017). This concept of wellbeing has been studied in different dimensions through different definitions in a wide variety of areas (e.g. health, education, economy etc.). Similarly, OECD (2017) has considered well-being at school in terms of psychological, physical, cognitive, and social contexts. When considered within the classroom context, well-being changes depending on the classroom environment and the values adopted in that classroom environment (Hill et al.,

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2021). Likewise, mathematical well-being [MWB] is closely related to one's ultimate or core values in the context of positive emotions in mathematics education (Hill & Seah, 2022).

Based on these considerations, this chapter aims to determine students' mathematics (mathematical values and mathematics educational values) values in Türkiye according to their feeling good about dealing with mathematics in school. For this aim, the mathematics values of Turkish Grade 9 students who think/do not think that mathematics is taught well in schools and who feel good or, on the contrary, feel bad while dealing with mathematics are only reported here, as an extreme or deviant case sampling, in Turkish schools.

20.1.1 Theoretical Background

This section discusses the relationships between culture, values, mathematics, and student values emerging in the context of well-being in mathematics classroom practices.

20.1.1.1 Relationships Among Culture, Values, and Mathematics

Culture is defined in this chapter as "a way of dividing people into groups according to some features of these people which helps us to understand something about them and how they are different from or similar to other people" (Scollon et al., 2012, p. 3). In this context, culture encompasses communication (language, symbols, and artifacts), interaction (traditions, practices, and patterns of interaction), and values (shared values, beliefs, norms, and expectations) that guide people or groups (Pang, 2005). As can be seen from this, each culture and educational system may have its own culture and different student expectations. Since there has been a clear and transparent link between culture and the quality of the education system (see Williams, 1961), the concepts of culture and education are already intertwined. Therefore, sociocultural factors are crucial in transferring education structure, content, and processes to new generations (Powe, 1993).

On the other hand, although values and valuing ideas are always totemic in education, these ideas bring out some problems when applied to mathematics. Even nowadays, mathematics is considered a value-free discipline (Bishop, 1991) by most mathematics teachers and students. According to them, school mathematics consists only of learning the skills of manipulating numbers, some abstract ideas of algebra, and dealing with sometimes geometry and measurement concepts. Similarly, mathematics learning for students in schools is limited to using and learning pedagogical methods and strategies to provide good marks on tests and exams (Clarkson et al., 2019). Mathematics is therefore seen as the discipline least affected by sociocultural factors (Stigler & Perry, 1988). However, in recent years, mathematical education research and practices have begun to discuss this from a critical perspective against

this judged approach to mathematics and learning/teaching mathematics (Clarkson et al., 2019). So, there are more recent claims in the literature that mathematics is value-laden and is, thus, influenced by culture (see Bishop, 1988; Ernest, 2007). From this perspective, it is also noted in the literature that students' high achievement in mathematics is more closely related to cultural values rather than specific mathematics teaching approaches (Askew et al., 2010). In this sense, students' learning and understanding of mathematics may vary in different cultures and societies (see Dede et al., 2020). Hence the same classroom practices may reflect different underlying values across cultures in which a particular value can be espoused differently (Hill & Seah, 2022). Thus, values affect the learning practices and processes of individuals/students in general, and mathematics learning in particular, because values are enacted beliefs and deep affective structures in the minds of individuals (Bishop & Seah, 2008). They have a crucial function in learners' choice of whether to engage in mathematical tasks (Bishop et al., 2006). In this context, Seah and Andersson (2015) definition of value is useful:

> The convictions that an individual has internalized as being the things of importance and worth. What an individual values defines for her/him a window through which s/he views the world around her/him. Valuing provides the individual with the will and determination to maintain any course of action chosen in the learning and teaching of mathematics. They regulate how a learner's/teacher's cognitive skills and emotional dispositions are aligned to learning/teaching in any given educational context. (p. 169)

In general, Bishop argued quite early in his writing that values are one of the critical factors underlying individuals' decision-making processes (see Bishop & Whitfield, 1972). But he, with others, gradually expanded on this general argument. So, values can be viewed as both a sociocultural and conative variable in the learning environment and processes of mathematics (see Goldin, 2019; Seah, 2019). Because while the sociocultural environment shapes our values (Seah, 2019), conative variables "regulate the individual's activation of cognitive skills and affective dispositions in complementary ways" (Seah, 2019, p.107). In this sense, three practical value frameworks have been proposed for mathematics classes, two of which are directly mathematics education and the other specific to cultural values. Firstly, Bishop (1988) proposed three main categories for classifying values taught in mathematics classrooms: general education, mathematical values, and mathematics educational values. These values cannot be completely separated from each other (Seah & Bishop, 2000). Then, Lim and Ernest (1997) proposed three classifications for the values taught in mathematics lessons: epistemological, social and cultural, and personal values. Here, the epistemological values proposed by Lim and Ernest (1997) can, to some extent, be associated with the mathematical values of Bishop (1988). Similarly, the social and cultural values suggested by Lim and Ernest (1997) may be related to Bishop (1988) general educational value category. Finally, Lim and Ernest (1997) personal values category may be evaluated in the category of mathematics education values of Bishop (1988) (see Dede, 2011).

As for cultural values, Hofstede (1980, 2023) determined that cultural values differed between countries and proposed the following six cultural dimensions: power distance index (high versus low), individualism versus collectivism, masculinity

versus femininity, uncertainty avoidance index (high versus low), long- versus short-term orientation, and indulgence (see Hofstede, 1980, 2023). Cooper et al. (2007) evaluated the reflection of these cultural values of Hofstede on classroom practices. According to this evaluation, in societies such as Türkiye, with collectivism, a high-power gap, and a high uncertainty avoidance, the teacher-centered teaching approach is at the forefront; individuals are asked to make sacrifices for society, and uncertain situations are not emphasized. On the contrary, in individual, low power range, and low uncertainty avoidance societies such as Germany, student-centered education is at the forefront, learning environments open to technological changes, uncertain, open-ended, and even conflict environments are designed as an element that encourages teaching. However, it should be noted here that Hofstede's cultural dimensions are not the ultimate focus for studying countries and therefore are not taken as absolute data. In this context, these cultural dimensions are used in this section only to assess what some of the findings mean.

20.1.1.2 Student Values Emerging in the Context of Well-Being in Mathematics Classroom Practices

MWB is fulfilling one's ultimate or core values, accompanied by positive feelings and functioning in mathematics education (Hill & Seah, 2022). In this context, a sense of well-being will likely change according to culture, society, school/lesson culture, and the values attributed to that culture and lesson. Also, an individual's well-being in mathematics may be expected to differ from the well-being experienced in other lessons (e.g., music) depending on the degree to which they perceive and value the lesson (Hill et al., 2021). In this sense, Clarkson et al. (2010) proposed a framework of MWB that considered three domains: a cognitive domain as knowledge and skills needed to do mathematics at school, an affective domain as combining values in mathematics education, and finally, an emotional domain as feelings and reactions to mathematics. According to Bishop (2012), one of the important features of MWB, which represents a new way of thinking about value development in mathematics education, is a developmental rather than just a sequential form. In this way, MWB offered valuable data for classroom practices for researchers, especially teachers, and in this context, Bishop (2012) proposed the six stages of the construct of MWB. These stages, from simple to complex, are awareness of mathematical activity, recognition and acceptance of mathematical activity, positively responding to mathematical activity, valuing mathematical activity, having an integrated and conscious value structure for mathematics, and finally, independently competent and confident in mathematical activity (see Bishop, 2012).

On the other hand, Hill and Seah (2022) stated that the MWB framework of Clarkson, Bishop, and Seah has some limitations and claimed that the framework was not fully compatible with the many later contemporary conceptualizations of well-being or human flourishing. They also noted that the framework neglects some social aspects of well-being and learning mathematics and has not been validated for school-age students. They proposed different dimensions of a MWB framework

identified within positive psychology linked to positive mathematics outcomes with descriptions of the dimensions and examples of supporting studies. Their seven dimensions are accomplishment, cognitions, engagement, meaning, perseverance, positive emotions, and relationships (see Hill et al., 2021). Considering that the values affecting learning mathematics processes are like the MWB dimensions (Hill & Seah, 2022), these MWB dimensions may affect whether a student feels profoundly good when doing mathematics. Tiberius (2018) discussed values at two levels according to their impact on well-being.

> ... I mentioned that there are ultimate values and instrumental values. We value some things (like friendship, health, and meaningful work) for their own sake and others (money, healthcare, and a college diploma) as a means to something more ultimate. I don't think the line between ultimate and instrumental values is always a bright one for people. ... It does matter that some goals we have are so clearly instrumental that it starts to strain the notion of "value" to call them values. For example, I aim to floss my teeth regularly to avoid gum disease and ultimately for the sake of my physical health. It would be odd to say that I value flossing my teeth.... When this happens, I think it's more natural to talk about desiring the means to a more ultimate value… (pp. 42–43)

Hill and Seah (2022) discussed the difference between these two values when directly associating them with classroom practices. For this, they considered values such as teacher-student relations, group work, or respect as instrumental values, and the value of relationships that are tried to be reached along these values as an ultimate value. In addition, they stated that instrumental (mathematical) values sometimes allow for more than one ultimate value through the following example: valuing teacher explanations can provide the valuing of relationships, such as the teacher providing support, cognitions such as facilitating better understanding, and accomplishment, such as explanations enhancing mathematical accuracy.

In recent years, it has been observed that there has been an increase in the number of studies based on different regions and cultural backgrounds to determine student values in mathematics classrooms (some of which appear in this volume). As mentioned before, because different cultures contain different values, mathematics teachers working in other cultures do not teach the same societal or pedagogical values even if they teach the same curriculum (Bishop et al., 2000). Thus, these studies investigating student values in mathematics classrooms naturally reach different results. As for recent studies about student values, for example, Dede (2019) found relevance, practice, rationalism, and fun values for Turkish students and relevance, fun, rationalism, and consolidating values for German students. On the other hand, he also identified three value categories for Turkish immigrant students in Germany: relevance, rationalism, and communication. When these values are considered in the context of MWB, Turkish and German students emphasize the values of rationalism, relevance, and fun. Accordingly, this student group aims at the ultimate values of cognition, meaning, and positive emotions in the context of MWB. On the other hand, immigrant students differ from these two groups and prioritize the ultimate value of relationships through the instrumental value of communication. In a slightly different context, Aktaş et al. (2021) examined the mathematics educational values of students in religious vocational middle schools in Türkiye, where

religious content and contexts are taught more intensively. And they determined that the importance given by the students in these schools to instrumental values such as relevance, learning approach, consolidating, and practice decreased as the grade level increased. From this, it can be said that the students in these schools prioritize the ultimate values of meaning, cognition, and engagement (and perseverance), respectively, through the instrumental values of relevance, learning approach, consolidating, and practice.

Moving to different cultures, Hong Kong students stated that fun, achievement, student participation, and teacher support are essential for effective mathematics learning (Law et al., 2012). From this, it can be stated that Hong Kong students emphasize the ultimate values of positive emotions, accomplishment, engagement, and relationships through the instrumental values here. Hunter (2021), on the other hand, found that Pāsifika students in New Zealand prioritized the instrumental values of practice, family, respect, and persistence in their mathematics classrooms. Accordingly, Pāsifika students in New Zealand emphasize the ultimate values of engagement and perseverance, relationships, positive emotions, and perseverance. Finally, Pang and Seah (2021) determined that Korean students emphasized the values of understanding, connections, fun, accuracy, and efficiency in their mathematics learning. For this, Korean students give more importance to the ultimate values of cognition and meaning, positive emotions, accomplishment, and engagement.

20.2 Research Process

The Turkish education system generally has a rationalist philosophy in terms of epistemology, a deductive philosophy in terms of problem-solving approaches, a centrally directed philosophy in terms of management approaches, and finally, a society-centered (i.e., Durkheimian) philosophy in terms of the criterion of correct knowledge (Hesapçıoğlu, 2009). In this sense, Türkiye's current education system structure has shown a growing tendency towards reform-driven student-centered approaches, particularly since the early 2000s when the curriculum was updated four times in 2005, 2009, 2013, and 2018. In this sense, the current mathematics curriculum in Türkiye also gives more attention to developing everyday skills such as using Turkish correctly, effectively, and beautifully, critical thinking, creative thinking, decision-making, and information technologies. (Ministry of National Education of Türkiye [in Turkish: MEB], 2018). Also, ten moral and cultural values, such as justice, friendship, honesty, self-control, patience, respect, love, responsibility, patriotism, and benevolence, have been included in the curriculum since 2018.

Compulsory education in Türkiye is 12 years. The first four years are called primary school (Grades 1–4), the second four are called middle school (Grades 5–8), and the last four are called high school (Grades 9–12). The Turkish education system generally focuses on getting a promising career on high-stake exams with multiple-choice tests, which puts pressure on Turkish students and their families (Dede & Tasos, 2019). In this context, this chapter aimed to determine Turkish

Grade 9 students' mathematics values in the context of the MWB. These Grade 9 students in Türkiye are first-year high school students and can be a good resource for assessing the values conveyed from middle school to high school. As for determining values, qualitative research designs are used to measure values because of the nature of values (Seah, 2008). In recent years, there has been a trend toward research on the determining and developing values in mathematics classrooms, and as a result of this interest, measuring values in the classrooms have been assessed using valid and reliable Likert-type measurement tools (see Akyıldız et al., 2021; Dede, 2011; Dede & Tasos, 2019; Seah et al., 2017; Zhang et al., 2016 for Likert-type scale and, Dede et al., 2022 for bipolar scale). In this context, this chapter planned to measure values in mathematics classrooms using a different measurement tool than the ones mentioned above.

In this explanatory sequential mixed design study, firstly, quantitative data were collected. Then qualitative data were collected and analyzed to explain and deepen the understanding of the quantitative data (see Creswell & Plano Clark, 2018). In this context, quantitative data in this study were obtained through two different questions. The first was acquired by a Likert-type question form, including the statement, "I learn mathematics well at school." This form was given to 343 Grade 9 students selected according to the deviant or extreme sampling method, one of the purposive sampling methods (see Cohen et al., 2011). Accordingly, students who marked the numbers 1 (if they did not learn mathematics well at school) and 5 (if they learned mathematics well at school) for the Likert-form question "I learn mathematics well at school" were determined. In this chapter, only the answers given by these students were analyzed and reported.

The second question was, "Imagine that we are going to produce a magic pill. Anyone who takes this magic pill will become very good at mathematics! What will you choose to be the top 3 main ingredients of this magic pill?" It was derived from a semi-open-ended question expressed as "Be imaginative; this main ingredient can be something we can touch and see or something we can feel but cannot see, for example." In this semi-open-ended question, students were asked to write three components of importance and justify their reasons for choosing them. By trying to measure students' values through such a semi-open-ended question, it is considered that the closed measure of quantitative approaches and incomplete assessment of qualitative approaches are avoided, allowing researchers, especially participants, to focus more on the phenomenon under investigation. The study's qualitative data were obtained from semi-structured interviews with the students to determine the details and the underlying reasons for the answers to the above questions.

Examination of the students' responses showed that 79 of the 343 (23%) Grade 9 students marked 1, and 68 of the students (nearly 20%) marked 5. As can be seen, the percentages and numbers of both groups are close to each other, hence it is legitimate for comparisons between both groups of students. Thus, the data of a total of 147 students were analyzed and reported.

Interestingly the 147 students whose data were analyzed gave different answers to the magic pill question. Although they were asked to state three main ingredients, which most did, some wrote 4, and some wrote just one main ingredient. For this

reason, the number of students differ for the value category frequencies. The data were analyzed using the constant comparative analysis method. In this context, firstly, some codes were created according to the open coding of the data. These codes were developed by examining the students' answers line by line, dividing them into parts, and assigning words with similar meanings to the same code. After the codes were created, they were examined in detail, and appropriate categories were developed which encompassed groups of codes (see Strauss & Corbin, 1998). In addition, the data were quantified by giving the frequencies of these values categories.

The study's qualitative data were obtained from semi-structured interviews with ten Grade 9 students (students selected according to the deviant or extreme sampling) to determine the possible reasons underlying these emerging categories. For example, one of the value categories that emerged was "ability." During the interview, students were asked, "Can ability be one of these main ingredients? Please explain." The value categories obtained in the study are discussed and reported together with the reasons given by the students. An example of the coding process for two value categories is shown in Table 20.1.

Different reliability methods have been used to ensure the reliability of the study data. Member checking (see Birt et al., 2016, for details) was used first. Transcripts of student answers in the interviews were made for this purpose and submitted for students' approval without any changes to the transcripts (see Creswell, 1998). Following this, the answers given by the students were first read a few times independently by the three researchers (authors of this chapter) and categorized through open coding. Then, these categories, which the researchers created independently, were discussed together by the researchers. These codes and categories, which the researchers developed together, were sent to two experts with a doctorate in mathematics education for review. To conclude this process, a consensus was sought on the codes and categories, taking into account the external experts' comments. Hence peer review was used for the second reliability of the data analysis (Lincoln & Guba, 1985). Also, the participants' statements were directly included in the text, and attention was paid to a thick description and richness in reporting the findings (see Creswell, 2012). Finally, the values emerging in the current study were assessed in the context of Bishop's (1988) and Lim and Ernest (1997) mathematics values,

Table 20.1 Sample analysis of student statements

Expressions for ability value	**Reasons in an interview for inclusion in this category**
Being good at maths	Statements "being good at mathematics" and "mathematical intelligence" indicate ability
Mathematical intelligence	
Expressions for teacher value	**Reasons in an interview for inclusion in this category**
Listening to the teacher	These statements refer to an activity that is directly related to the teacher
Teaching method	
Teacher	

Hofstede's (1980, 2023) cultural values, and the MWB of Hill et al. (2021) frameworks. Thus, theoretical triangulation was implemented on the values (see Cohen et al., 2011).

20.3 Findings

As a result of the analysis of the answers given to the "magic pill" question by the students who marked the 1 and 5 Likert categories for the "I learn math well at school." Six value categories were obtained: Ability, effort, mathematics concepts, fun, teacher, and materials that enhance thinking. The percentage frequencies related to these values are given in Table 20.2. Although the number of students in the two groups is similar, the number of responses for the groups is quite different: 153 compared to 127. Hence in the analysis, percentage frequencies are compared in the Table.

The explanations for each of the six values given in Table 20.2 are as follows:

Ability: With this value, it is stated that ability is essential in mathematics and mathematics learning. When the students' answers were examined, it was found that the students who thought they learned mathematics well at school attributed more importance to ability while learning mathematics (in percentage) compared to those who did not think that they learned mathematics well. However, as can be seen from Table 20.2, the percentages of both groups of students are close to each other. Therefore, it can be said that both groups of students attach more or less equal importance to their ability while learning mathematics. In addition, as seen in Table 20.2, both groups of students state that ability is the most critical component in mathematics learning. The sample statements of the students in both groups about the ability category are given in Table 20.3.

In the semi-structured interviews conducted with the students in these two groups (who marked the 1 and 5 options for the relevant question), they were asked to explain

Table 20.2 Student choices for the "I learn mathematics well at school" and value category frequencies of "magic pill."

Value categories	1	5
Ability	27.45%	33.07%
Effort	18.95%	16.54%
Mathematical Concepts	18.95%	13.39%
Fun	16.34%	13.39%
Teacher	11.11%	14.17%
Materials Enhance Thinking	7.19%	9.45%
Totals (f)	153	127

1: Students who think that they did not learn mathematics well at school

5: Students who think they learned mathematics well at school

Table 20.3 Sample student statements of ability value

Learned mathematics well (5)	Didn't learn mathematics well (1)
Maths is certainly about intelligence and attention Ability Intelligence, ability to understand Being good at maths	Intelligence is very important Ability to understand Ability to solve questions Without talent, people don't want to do anything

why the ability value is an important component in mathematics learning. Since the S1-coded student, who believes that he does not learn mathematics well at school, and the S5-coded student, who believes that he has learned mathematics well at school, made explanations that more clearly reflect the characteristics of their own categories, it was preferred to use the expressions of these students while exemplifying the semi-structured interviews. In this context, the following is an excerpt from an interview regarding the ability value of a student who stated that he learned mathematics well at school and marked himself as 5, not a typical student of this group. (including the effort value) (R: Researcher, S5: a student who stated that he learned mathematics well at school):

> R: Could ability be one of the components of learning mathematics?
>
> S5: Yes. Ability matters the most.
>
> R: Why? Can you explain a little more?
>
> S5: For example, two people love football. One of these two people is Ronaldo, and the other is another football player. Both football players love football. The other football player can't be a Ronaldo, he can go up to a level, but he can't be a Ronaldo. Such ability matters.
>
> R: Is putting in the effort a part of learning math? What do you think?
>
> S5: Of course, it's important to put in the effort. A little effort gives rational value. But as I said in the previous example, he cannot reach the level of those with high ability and cannot be a Ronaldo even if he puts in the effort.

Effort: This value emphasizes the importance of study, effort, persistence, etc. while learning mathematics. As seen in Table 20.2, the percentage of the effort value are close to each other in both groups of students who think they have learned mathematics well at school and those who do not. In addition, students who do not think they learned mathematics well at school emphasized this value more in learning mathematics than those who did. Some sample student statements are given in Table 20.4.

Table 20.4 Sample student statements of effort value

Learned mathematics well (5)	Didn't learn mathematics well (1)
Effort Studying yourself Hardworking Regular study	Being hardworking Studying hard Make a person hardworking Study

Here is an excerpt from an interview regarding the ability value of a student who stated that he did not learn mathematics well at school and marked himself as 1, not a typical student of this group. (including the ability value) (S1: a student who stated that he did not learn mathematics well at school and marked 1):

R: Could ability be one of the components of learning mathematics?

S1: Yes.

R: Why? Can you explain a little more?

S1: Ability and intelligence are necessary to learn mathematics very well.

R: How are intelligence and ability required in mathematics? Can you explain?

S1: Yes, it is required. Because if you have a talent for mathematics, you will learn the subject more easily.

R: If you need the ability for math?

S1: Those who don't have the talent can make up for it by putting in the effort because you can do the math by studying.

R: Then you say that you can learn mathematics by studying?

S1: Yes. Those without ability do not learn as easily as those with ability. For example, those who have the ability can understand by studying for a short time. Those who don't have the ability have to spend a long time. As I said, if we don't have the ability, we can reach a certain level by working.

R: Here, you specified the level. Can you explain the level you stated in terms of ability and effort?

S1: Those with talent pass this level. Those who put in the effort do not go as far as those with talent. Because with talent, they learn in a short time.

Mathematical Concepts: This value indicates the importance of knowing and understanding mathematical concepts, definitions, processes, etc., in mathematics learning. As seen in Table 20.2, both groups of students rated this value relatively highly than the other values. However, it can be said that students, who do not think they learned mathematics well at school, emphasized mathematical concepts somewhat lower in percentage than the other group. However, as seen from the interview excerpts below, it has also been revealed that these students lack understanding regarding the role and place of mathematical concepts in mathematics learning. In addition, although students in both groups emphasized different mathematical concepts for mathematical concept value, they generally emphasized mathematical formulas, operations, and the use of these formulas and functions (see Table 20.5).

Here is an excerpt from an interview with a student who stated that he did not learn mathematics well at school regarding this value:

Table 20.5 Sample student statements of mathematical concepts value

Learned mathematics well (5)	Didn't learn mathematics well (1)
Formulas	Four operations
Four operations	Formulas
Algebraic expressions	Angles
Shapes	Ratio theorem

R: Are mathematical concepts important in learning mathematics? Can you explain?

S1: Knowing some formulas might help.

R: Which formulas? Can you give an example?

S1: For example, algebraic expressions.

On the other hand, below is an excerpt from an interview with a student who stated that he learned mathematics well at school:

R: Are mathematical concepts important in learning mathematics? Can you explain?

S5: Yes. Since some mathematical concepts are included in many other mathematics subjects, we learn mathematics better if we know these concepts related to other mathematical subjects. However, I don't think that knowing these mathematical concepts that are related to other mathematics subjects will have much effect on our learning of mathematics because one can learn any subject later by studying it.

Fun: This value expresses having fun, being happy, loving mathematics, and having self-confidence while doing or learning mathematics. As seen in Table 20.2, both groups of students emphasized the value of fun in mathematics, especially those who did not think they learned mathematics well in school (see Table 20.6).

Two short excerpts from the interviewed students' opinions about the fun value are given below:

S1: Because doing a lesson you love is always easy and fun.

S5: We want to do more if we have fun at what we do.

Teacher: This value includes the teachers' teaching method in mathematics learning, the teachers' characteristics and behaviors, and the teachers' communication with students. In this context, students in both groups emphasized the teacher factor while learning mathematics (see Table 20.2). Some sample student statements regarding this value are given in Table 20.7.

Here is an excerpt from an interview with a student who stated that he did not learn mathematics well at school and about teacher value:

Table 20.6 Sample student statements of fun value

Learned mathematics well (5)	Didn't learn mathematics well (1)
To get pleasure from maths	Love the numbers
It is a hobby to get pleasure	Fun math
Math should be fun	Make people laugh
Self-confidence	Love of math

Table 20.7 Sample student statements of teacher value

Learned mathematics well (5)	Didn't learn mathematics well (1)
Teacher	Listening to the teacher
If a teacher teaches math well	A teacher should be friendly
Teacher to be like our fellow	Get on well with maths teacher
Medicine to make maths teacher amusing	Teacher's way of teaching

R: Could teachers be one of these components?

S1: Yes, the teacher is important.

R: Can you open a little more?

S1: Because the teacher should know how I learn better. And he must make me love the lesson.

R: You talked about making the lesson loved. Can you explain? What does it mean to make the lesson loved?

S1: The teacher can either make the lesson loved or hated. If I love the lesson, I will want to learn.

R: Are you saying that after the teacher, loving the lesson is also important in learning mathematics?

S1: Yes. I said if I love, I will work better and more willingly.

On the other hand, below is an excerpt from an interview with a student who stated that he learned mathematics well at school about the teacher's value:

R: Could teachers be one of these components?

S5: It could be. If a person's math teacher is good, his life will improve. For example, I found my middle school math teacher close to me as a friend. I would study and listen to the lesson so there would be no disrespect to the teacher. He made me love maths.

R: You talked about loving math class. So, can loving math be a component of learning math?

S5: Yes, it is important. Because if you don't like math, you'll have some issues learning it. But you still learn, but you struggle.

Materials Enhance Thinking: This value emphasizes some foods, materials, and concepts such as enzymes, honey, green tea, almonds, and sleep, which are thought to improve students' thinking skills and capacities while learning mathematics. In this context, both groups of students emphasized these foods and materials, which they thought developed thinking while learning mathematics (see Table 20.2). Some sample student statements regarding this value are also given in Table 20.8.

The interviews conducted with the students regarding this value determined that the students in both groups generally put more emphasis on some foodstuff. Although students in both groups give the highest importance to the value of talent, they relatively less emphasize materials that can increase their thinking capacity and, therefore, their abilities (the value they attach the most importance to) (see Table 20.2). Two short excerpts from the interviewed students' views on this value are given below:

Table 20.8 Sample student statements of materials enhance thinking value

Learned mathematics well (5)	Didn't learn mathematics well (1)
Enzymes to make the brain operate	Sleeping regularly
Nutrition	Hazelnut and walnut
Fish oil	Red meat
Lime tea, lemon, honey	Candy for learning and comprehending

Table 20.9 Category comparison of Hill et al. (2021) and the current study

Current study	Hill et al. (2021)
Ability	Cognitions
Effort	Perseverance
Mathematical concepts	Cognitions
Fun	Positive emotions
Teacher	Relationships
Materials enhance thinking	Cognitions

S1: It could be. For example, reading a book is one of them; it increases your intelligence and thinking.

S5: Yes, because substances that increase your intelligence and memory also increase your learning.

20.3.1 Discussion

The results of this study suggested that there were six values that this group of Grade 9 students in Türkiye consider the most important in learning mathematics: ability, effort, mathematical concepts, fun, teacher, and materials to enhance thinking.

These six values were evaluated within the scope of instrumental values. In contrast, the MWB categories specified in the study of Hill et al. (2021) were evaluated within the scope of ultimate values (see Tiberius, 2018). In this context, the MWB equivalents of 6 instrumental values in the study of Hill et al. (2021) are presented in Table 20.9. It should be noted here that some values that emerged in the current study may be considered under more than one MWB category/dimension at the same time (for example, the value effort may be considered in the context of perseverance and accomplishment MWB categories).

In the current study, unlike Hill et al. (2001), it was determined that the values that both student groups attach importance to in the learning of mathematics are generally similar, even if the students' levels of feeling good in mathematics (MWB) were different. One reason may be that students see ability, effort, and teachers as the most important factors for success in mathematics, as evidenced by the semi-structured interviews. The fact that teaching in Türkiye, in general, and mathematics teaching, in particular, is exam-oriented (Dede & Tasos, 2019) may be why Turkish students consider these three values more important in learning mathematics. This is because, in Türkiye, mathematics questions (together with Turkish) play a leading role in the exams held for the selection of high school and especially university students. Besides math ability, this situation highlights that Turkish students should prepare for these exams by solving as many mathematics questions as possible and clearly their mathematics teachers and their teaching practices are crucial for this while they are learning mathematics. Similar results were obtained in other studies

conducted with Turkish students (see Aktaş, Akyıldız & Dede, 2021; Dede & Tasos, 2019; Dede et al., 2022; Dede et al., 2023).

In addition, it can be said that these results coincide with the mathematical values prominent in the study of Hill et al. (2021). This is because cognitions and accomplishment ultimate values emerged more in the study of Hill et al. (2021). Similarly, in the current study, the ability value of cognitions ultimate values, which can be considered an instrumental value, has come to the fore as the value students see as most important while learning mathematics. One reason for this may be that, as Hill et al. (2021) stated, the questions in the questionnaire led students to think of mathematics as more cognitive and achievement oriented. As mentioned before, Turkish students are likely to have developed an achievement-oriented perspective in mathematics due to the central high-stakes exams in Türkiye. For this reason, Turkish students can see the ability value as the cornerstone of mathematical success, as can be understood from semi-structured interviews.

In addition, the results of this study are like Weiner's (1985) causal attribution theory. In Weiner theory (1985), effort and ability are stated as internal causal attribution, and luck and task difficulty as external causal attribution. On the other hand, in this study, the categories of ability, effort, and fun, which the students emphasized most, overlap with Weiner's work as internal causal attribution. The other categories of this study, mathematical concepts, teacher, and materials enhancing thinking, can be considered external causal attribution.

In the current study, the effort value is another value obtained for students in both extreme groups. The effort value considered an instrumental value, can be linked to the perseverance's ultimate value of Hill et al. (2021). Unlike the study of Hill et al. (2021), in the current study, effort emerged as the value that Turkish students attach the most importance to in learning mathematics after ability. In the study of Hill et al. (2021), it can be said that although the value of perseverance is among the values that students give less importance to in learning mathematics, the value of perseverance ultimately supports and complements the values of cognition and accomplishment. In this context, it can be said that the results of the current study are similar at this point. Still, due to different cultural understandings and insights (Hill & Seah, 2022), Turkish students can consider this value differently. Additionally, Dede et al. (2022) determined the values of Turkish students with the bipolar scale; the ability-effort values were positioned as the two extreme values of the bipolar scale. In Dede et al. (2022) study, students preferred the effort value more than the ability value. In the current study, the ability value was emphasized more than the effort value of Turkish students in learning mathematics. However, it was determined that the students answered the questions in an open-ended manner. Considering the structure of the bipolar scale (choosing one of the two extreme values), Turkish students still attach more importance to these two extreme values (ability-effort) than the other values in the learning of mathematics.

Another value that students chose in this study is the fun value. This fun value can be evaluated in the context of an ultimate value of positive emotions by Hill et al. (2021). In a study where Dede et al. (2022) determined the values of Turkish students with the bipolar scale, it was determined that the students whose pleasure

(fun)-hardship values were positioned as the two extreme values of the bipolar scale, they gave more importance to the pleasure (fun) value than the hardship value. The fun value emerged at a frequency close to other mathematical values in the current study. Semi-structured interviews also revealed that students liked mathematics as a component of learning mathematics. At the same time, the value of fun emerged in Turkish and German students representing two different cultures in the study of Dede (2019), in which he examined the values of Turkish, German, and Turkish immigrant students living in Germany in mathematics classes, while I did not emerge for Turkish immigrant students (in acculturation process). On the other hand, Hill et al. (2022) state that when students understand mathematics, positive emotions occur, and positive emotions trigger engagement. In this context, in the current study, the values of ability, effort, and fun can be considered three values that interact.

On the other hand, although the peer instrumental value is more prominent in the relationships of an ultimate value in the study of Hill et al. (2021), it is remarkable that in the current study, only the teacher-instrumental value is emphasized by the students in the context of this ultimate value. One of the reasons for this situation can be shown as the fact that Turkish society is a collectivist society (see Hofstede, 1980, 2023), which means that the teacher is seen as a dominant figure and plays a role in classroom practices (see Cooper et al., 2007). In addition, the competitive structure of the education system in Türkiye, which is exam-oriented, causes teachers to make their teaching exam-oriented. This situation causes students to prefer teachers who prepare the best for the exam, solve the most questions while learning mathematics, and keep the interaction and sharing between peers at a limited level in this competitive environment. A similar situation manifests itself mainly in Asian students, and the idea of "practice makes perfect" puts much pressure on these students (Zhang et al., 2016).

Finally, the materials enhance thinking and mathematical concepts instrumental values obtained in the current study can be evaluated in the context of cognitions ultimate value of Hill et al. (2021). The cognitions ultimate value includes values related to the scientific discipline of mathematics (for example, rationality) (see Atweh & Seah, 2008). It represents the common values that emerge in mathematics classrooms in all cultures. For example, it is frequently noted in the literature that the common value that Turkish and German students (see Dede, 2019) and Asian students (see Zhang et al., 2016) give the most importance while learning mathematics is the value of rationality.

20.4 Moving On

The six values identified by students in the current study suggest that they see mathematics as a worthwhile and doable subject, as it has complementary properties in mathematics learning and causes students to feel good about themselves (MWB). This is because students approach mathematics in ways that can be more harmful than many other school lessons. It is essential to understand the well-being of students

(MWB) in mathematics education and to prepare supportive teaching environments and processes based on this understanding to change and improve the way mathematics is perceived and experienced by students (see Hill et al., 2021). This is because well-being depends in part on one's values and generally on the context (Hill et al., 2021), as determined by the characteristics of one's environment (Alexandrova, 2017). For this reason, values (and attitudes) are positioned in the OECD Learning Compass 2030 among the things that students should gain alongside knowledge and skills within the framework it offers to reveal students' potential and contribute to the well-being of societies. In this context, this study may contribute significantly to the literature on students' MWB. The sampling used in this study does suggest that these results may well generalize to the wider population of students.

There are also implications for teacher practice. Teachers were shown to be an essential value for mathematics learning in the current study. It follows that they can increase students' interest in mathematics and their success if they prepare environments and processes that support students' MWBs. This notion is supported by an argument from Waters et al. (2019) who determined that when the well-being of students is supported, in particular, the value of perseverance increases, leading to students' academic success. In this context, as revealed in the semi-structured interviews, it is also essential for teachers to establish good relations with students and support their positive emotions towards mathematics. Thus, with the development of students' MWBs, they become more engaged in mathematics. Ensuring teacher and student values alignment is another factor that supports students' MWBs. Kalogeropoulos and Clarkson (2019) found that when teachers align their classroom pedagogical values with their students' values, student engagement in the learning of mathematics increases. In other words, student engagement can be increased by supporting students' positive emotions.

This study is limited to the answers given by the students to the magic pill question. Building on this restricted context, it may be useful to conduct further research focused on classroom observations to reveal the reflections of the student values obtained in classroom practices. In addition, even though both Türkiye and many countries have recently made massive investments in the technological integration of mathematics classes, Turkish students never emphasized the value of Information and Communication Technology [ICT] for the value of mathematics education. Similar results were found in studies in other cultures (see Hill et al., 2021; Dede, 2019; Zhang et al., 2016). In this context, further research may be conducted on why students do not mention ICT value.

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