Journal of Humanistic Mathematics

**Mathematical Experiences of Students in Turkish Context\***

1. Dr. Vahap Yorgun

2. Serdal Mert

\*Makalemiz değerlendirme aşamasındadır.

**Introduction**

Mathematics skills are essential in almost all grades of school education. When a student attends to primary school, her journey of math starts with numbers, symbols and basic skills of numeration. It became more complicate by the grades from numeration to geometry, complex number, derivative and integral that have specific symbols and rules. This may sound like a foreign language on behalf of students. Because the students may not develop a sense of meaning related with these symbols and concepts. Such a meaninglessness may create an uncertainty and anxiety.

Moreover, one may observe many bias and prejudices or irrational assumptions or myth about math and math learning widely hold in the society. For example, “only very clever and smart student can do math”, “I cannot do math then I am idiot” “I am not good at numeration” “I should choose social sciences because my math grades are not good enough”, “No matter what I do, I cannot do math, because I am not boy/girl of math”. These prejudices create a psychological distance between math and student and math turns to an unknown and foreign subject yielding anxiety (Mason, 2003; House, 2006; Nazlıçiçek, 2007). However, the literature on math learning or education clarified that all are irrational and not valid. Every person on the earth can do math. But the reasons of such beliefs are proved by researcher, in other words it is known that how a student develop such irrational beliefs related with math and the effects of them.

Though such a sense of alienation toward math, the students may develop a poor and low level of self-esteem. She/he may see the math as an unsolvable, hard and difficult operations and she/he cannot cope with. The result may be a poor and unrealistic math identity. By the time she/he behave in accordance with this identity: stop studying or trying and accept that he/she will never be able to do math. Mathematics becomes a unique source of anxiety (Hembree, 1990; Ashcraft, 2002; Maloney and Beilock, 2012) and academic failure (Dowker, Sarkar & Looi, 2016).

Some statistics provide invaluable findings about this issue. PISA test hold by OECD in 37 OECD member countries measuring reading, math and science skills of 15 years students and repeated every three years. According to the 2018 PISA results, the math mean of Turkish sample is lower than overall OECD average. The participants were assigned to levels based on their test achievement and while only 5 % of the Turkish sample achieve level 5 and above in math, this rate is 11 % for the OECD mean in math. (https://www.oecd.org/pisa/publications/pisa-2018-results.htm)

There may be numerous reasons for this situation. Math education, the characteristics of math teachers, teachings styles and methods, the attitudes of parents’ and overall society toward math and math success are some of these reasons. In addition the psychology of learning along with neuropsychological findings release that anxiety may be one of the most explicit factors blocking the learning process (McLeod, 1992; Ma and Kishor, 1997; Ho et al., 2000; Miller and Bichsel, 2004; Baloglu and Koçak, 2006 )

Turkish literature on math anxiety is limited respectively. Although some researches were conducted to determine the prevalence of the problem, investigate the relationship between math anxiety and several variables like attitudes toward math (Avcı, Coşkuntuncel & İnandı, 2011; Taşdemir, 2015), gender (Dede & Dursun, 2008; Tuncer & Yilmaz, 2016), self efficacy (Adal & Yavuz, 2017; Medikoğlu, 2020) any study including psychological intervention was detected. Similarly Alkan (2018) reviewed the researches on math anxiety in Turkish literature and found that majority of studies employed quantitative approaches.

Toptaş and Gözel (2018) reviewed the 43 master thesis on math anxiety and found that while 36 of them employed quantitative methods investigating the prevalence of math anxiety, the relationship with other variables, development of math anxiety scales and degree of math anxiety; remain 7 thesis focusing on different teaching style. Unfortunately any scientific effort to intervene math anxiety or qualitative research has been detected.

Moreover the findings of a study (Demir & Durmaz, 2018) revealed that math teachers as the participants of this research cannot detect math anxiety and have limited knowledge and skills to intervene or help students cope with this anxiety.

Therefore, in Turkish literature there is a need for qualitative studies that may provide findings which will be useful in developing intervention program and this research may contribute to fill this gap. Because in order to develop such a program, it should be known how math anxiety develop, what kind of variables or factors take place in this process, what kind of metaphors students hold about math. In this research, the mathematical attitudes of high school students who have poor math grade have been investigated. To do so, a qualitative method was employed and the findings were discussed in accordance with the relevant literature.

**Method**

The aim of this research is to clarify the experiences of high school students related with math. The researcher desired to know these feelings and thoughts deeply therefore it is decided to use qualitative method. In order to gather data about the participants’ mathematical experiences, a 14-item form was developed by the researcher. While six of them are about personal information yielding name of the school, gender, age, grade level and the educational level of parents; remains regarded with math experiences. These items are:

1- How many years old were you when you experienced your first advance or bad memory related with math?

2- Please explain in detail the memory affecting your self-efficacy about math adversely.

3- What do you think when you face with a math problem sounds you like a difficult or hard problem?

4- How do you feel when you face with math problem sounds you like a difficult or hard problem?

5- What do you do when you are trying to solve a math problem sounds you like a difficult or hard problem? How do you give up trying anymore?

6- Related with math, what do you think about yourself as being clever or smart?

7- Have you have any positive memory about math? If so, please give some detail

8- Please write three words, when you remember mathematics jump into your mind immediately.

First of all, school counselors of 6 high schools located in Bayraklı district of İzmir, Turkey were informed about the research and data collection instrument via a zoom meeting due to pandemic restrictions in June 2021. Then, the data collection instrument was send them to distribute it to 9th grade students with low math grade. 390 high school students with low math grade filled the online questionnaire send them via school counselor. Some of students filled the online from twice or released inappropriate answers. These were detected and excluded from data.

In this research the content analysis method was employed to analyses the qualitative data. Through content analysis, the researcher firstly codes the data. The code may be a single word or a sentence. Secondly, using these codes the researcher develops several themes. In other words, the codes developed before, are clustered into different categories at this stage based on semantic similarity or proximity. Finally, the themes are interpreted and discussed (Strauss & Corbin, 1998).

Firstly, the responses provided by the participants for each question was red and coded. Then the codes were categorized to develop certain themes for each question. This method is called content analysis in qualitative research literature (Yıldırım & Şimşek, 2006).

The number of participants was 390 and data about socio-demographic variables of gender, school type, grade and educational level of parents are presented below.

**Figure 1.** The Rate of Gender

Of the participants took place in the research 116 were male, while 274 were female.

**Figure 2.** School Type

Of the participants 263 were general high school students. These high schools provide academic education in Turkey. On the other hand 27 of the participants were vocational high school students and this type of high school predominantly focuses on teaching vocational skills.

**Figure 3.** Grade Levels

165 of the participants were 9th grade; 183 were 10th grade and 42 were 11th grade students. Because the target population of this study was 9 and 10th grade students, majority of the participants were 9th and 10th grade students.

**Figure 4.** Educational Level of Parents

Findings revealed that 24 of the mothers and 3 fathers have no schooling completion; 156 mothers and 137 fathers had primary school completion; 81 mothers and 84 mothers had secondary school completion; 94 mothers and 124 fathers had high school completion and 35 mothers and 41 fathers had university degree.

**Results**

The results will be presented question by question. Firstly the codes derived from responses for each question will be focus and then based on these codes the semantic themes will be introduced.

**Question 1: How many years old were you when you experienced your first adverse or bad memory related with math?**

**Figure 5. Q1:** How many years old are you when you experienced your first adverse or bad memory related with math?

In Turkish educational system, students attend the primary school when they reach their six years. After primary completion, they must join secondary and high school levels. Each level lasts for 4 years. Considering the ages, 6, 7, 8 and 9 years belong to primary level; 10, 11,12 and 13 belong to secondary level and 14, 15, 16 and 17 ages belong to high school level.

In line with results shown in Figure 5, 95 of the participants experienced an adverse memory when they were in primary school; 190 of the participants experienced such a memory when they were in secondary school and 67 of them experienced an adverse memory during high school grades. It can be concluded that most of the participants experienced a mathematical negative memory in the early years of education.

**Question 2: Please explain in detail the memory effecting your self-efficacy about math adversely.**

**Figure 6. Q2:** Please explain in detail the memory effecting your self-efficacy about math adversely.

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Codes** | **Frequency** | **Examples** |
| 1 | Overall math failure | 62\* | *I was 4th grade and took low grade from exam and I thought that I would never success the math.*  |
| 2 | Failure on a specific math topic | 29\* | *I studied the topic of clusters repeatedly but nothing so I thought that I could not do math.* |
| 3 | Meaningless | 4 | *Math sounds like meaningless to me. There is no any relation to real life.* |
| 4 | Teachers’ attitudes | 66\* | *When I was at secondary school our math teacher perpetually got angry with me when I couldn’t solve the problems in front of the class.* |
| 5 | Feeling humiliated | 17 | *When I was at secondary school math teacher forced me to solve the problem and when I couldn’t do it he humiliated me saying “you are idiot!” “Dou you have any brain?”* |
| 6 | Parents’ attitudes | 2 | *When my father heard that my math grade was low, he said this would never do well.*  |
| 7 | Sense of difficultness | 24\* | *Math is very difficult to me to have a sense**The topics are gradually become harder* |
| 8 | Not being able to see the points of a topic | 18 | *I cannot see the points when studying math whether by myself or learning from teacher.*  |

Based on the content analysis of memories, 8 codes derived by the researcher. These are “Overall math failure”, “Failure on a specific math topic”, “Meaningless”, “Teachers’ attitudes”, “Feeling humiliated”, “Parents’ attitudes”, “Sense of difficultness” and “Not being able to see the points of a topic”. The codes with highest frequency are “Teachers’ attitudes” (N=66); “Overall math failure” (N=62); “Failure on a specific math topic” (N=29) and “Sense of difficultness” (N= 24). In this vein, it can be stated that teachers’ ineffective, humiliating, discouraging and sarcastic behaviors, students’ perceptions about math as being very hard to learn and failing are mostly observed contents of mathematical first memories of participants.

**Question 3: What do you think when you face with math problem sounds you like a difficult or hard problem?**

**Figure 6. Q3:** What do you think when you face with a math problem sounds you like a difficult or hard problem?

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Codes** | **Other Codes with Semantic Similarity** | **Total Frequency** |
| 1 | Chaos with math knowledge |  |  |  |  |  |  | 11 |
| 2 | Cognitive chaos | Complexity and uncertainty | Mental confusion | Foreign language |  |  |  | 9 |
| 3 | Freezing |  |  |  |  |  |  | 9 |
| 4 | Emotional-cognitive chaos |  |  |  |  |  |  | 6 |
| 5 | Frustration |  |  |  |  |  |  | 1 |
| 6 | Accepted inefficacy | Negative self-talk | Negative expectation | Low self-esteem | Inefficacy | Irrational self- evaluation |  | 95 |
| 7 | Avoiding |  |  |  |  |  |  | 8 |
| 8 | Anger | Anger-self blaming | Hopelessness | Meaninglessness | Anxiety | Stress | Desperation | 44 |
| 9 | Self feed-back |  |  |  |  |  |  | 4 |
| 10 | Total negativity |  |  |  |  |  |  | 1 |
| 11 | Traumatic memory |  |  |  |  |  |  | 4 |
| 12 | Hard sledding | Hard Sledding-Overwhelming | Hard Sledding- reluctance |  |  |  |  | 16 |

Findings of Q3 revealed that when students are trying to solve a difficult –sounded math problem, they produce psychologically negative reactions. These reactions may become emotional, cognitive, behavioral and physiological as well. The codes with highest frequency are negative expectations (29 times), namely evaluate her/himself having low efficacy in math ability to solve a problem or holding negative beliefs related with math success; desperation ( 17 times), feeling of helplessness in case of math problems; anxiety (15 times), feeling worried about math problems; chaos with math knowledge (11 times), feeling confused about math knowledge; freezing (9 times), feeling stuck; avoiding (8 times), trying to not to face with math.

Considering total frequency, two categories of codes become obvious. First category includes accepted inefficacy (false premises about his/her own math competency), negative self-talk, negative expectation, low self-esteem, inefficacy and irrational self-evaluation. It can be concluded that the students with low math success develop a negative self-identity about math. The second category of codes includes anger, self-blaming, hopelessness, meaninglessness, anxiety, stress and desperation. In other words, negative mathematical identity may yield negative thoughts and self-evaluation.

**Question 4: How do you feel when you face with math problem sounds you like a difficult or hard problem?**

**Figure 7. Q4:** How do you feel when you face with math problem sounds you like a difficult or hard problem?

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Codes** | **Other Codes with Semantic Similarity** | **Total Frequency** |
| 1 | Pain |  |  |  |  | 1 |
| 2 | Meaninglessness | Emptiness |  |  |  | 6 |
| 3 | Hard sledding |  |  |  |  | 7 |
| 4 | Stress |  |  |  |  | 25 |
| 5 | Unsuccessful | Lazy | Inefficacy |  |  | 36 |
| 6 | Disgust | Exhausted | Depressed | Bored | Terrible | 23 |
| 7 | Freezing | Apathy | Mentally Freezing |  |  | 14 |
| 8 | Anxiety | Worry | Fear | Social anxiety | Panic | 65 |
| 9 | Physiologic reaction | Tension |  |  |  | 2 |
| 10 | Disappointment |  |  |  |  | 1 |
| 11 | Disinteresting | Reluctance |  |  |  | 6 |
| 12 | Avoiding |  |  |  |  | 2 |
| 13 | Pessimism | Hopeless | Helpless | Unhappiness |  | 31 |
| 14 | Frustration |  |  |  |  | 18 |
| 15 | Negativity | Negative thoughts |  |  |  | 36 |
| 16 | Anger |  |  |  |  | 16 |
| 17 | Self-blaming | Self-hate | Low self-esteem | Humiliated | Self-comparing with others  | 14 |
| 18 | Confusion |  |  |  |  | 1 |
| 19 | Sadness |  |  |  |  | 14 |

Results of Q4 clarified that when students are trying to solve a difficult –sounded math problem, they produce negative and strong feelings. The codes with highest frequency are negativity (35 times); fear (27 times); inefficacy (25 times); stress (24 times); anxiety (24 times); frustration (18 times); anger (14 times); helplessness (13 times); hopelessness (12 times) and bored (12 times).

Considering total frequency, six categories of codes become obvious. First category includes anxiety, fear, worry and panic. The second category includes unsuccessful, laziness and inefficacy. The parts of third category are negativity and negative thoughts about math success. Pessimism, hopelessness, helplessness and unhappiness constitute the fourth category. The fifth category includes stress while the codes in the last category are disgust, exhausted, depressed and bored. Therefore it can be stated that math failure may result in feelings of anxiety, fear, panic, low self-esteem and self-efficacy.

**Question 5: What do you do when you are trying to solve a math problem sounds you like a difficult or hard problem? How do you give up trying anymore?**

**Figure 8. Q5:** What do you do when you are trying to solve a math problem sounds you like a difficult or hard problem? How do you give up trying anymore?

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Codes** | **Other Codes with Semantic Similarity** | **Total Frequency** |
| 1 | Leaving the problem unresolved | Giving in | Not to try | 21 |
| 2 | Trying to use the knowledge I remembered |  |  | 2 |
| 3 | Being confused | Giving in when confused | Giving in when not to understand the topic | 9 |
| 4 | Feel froze  | Feel froze when not to understand the topic |  | 2 |
| 5 | Watching video about the topic | Studying the topic again and investigating the similar problems | Investigating the solutions for the similar problems | 3 |
| 6 | Reading the problem many times but no any result | Doing all my best but no any result |  | 2 |
| 7 | When all efforts fail I decided that I can not solve this | In case of false solution, I feel discouraged. |  | 7 |

Results of Q5 pointed out that when students are trying to solve a difficult –sounded math problem, they easily become confused and give up spending more effort on the problem. Many of the participants leave the problem unresolved, while some participants stated that they feel froze in case of a difficult math problem.

**Question 6: Related with math, what do you think about yourself as being clever or smart?**

**Figure 8. Q5:** Related with math, what do you think about yourself as being clever or smart?

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Codes** | **Other Codes with Semantic Similarity** | **Total Frequency** |
| 1 | Stupid | Foolish | İdiot |  | 12 |
| 2 | Unsuccessful |  |  |  | 25 |
| 3 | Unskillful | Untalented | Inefficient |  | 54 |
| 4 | Helpless |  |  |  | 2 |
| 5 | Math requires being intelligence | If you have math ability you can do it | One who can do math is intelligent | Math is a sign of intelligence | 22 |
| 6 | I have no math ability | I am not a man of numbers | I am bad at math | Math is not for me | 11 |
| 7 | Poor | One step behind |  |  | 2 |

Based on the result it can be pointed out that the participants think negatively about their math ability. They evaluated themselves as stupid related with math failure. The most frequented codes include being unskillful, untalented and inefficient; unsuccessful and myths about math such as “math require being intelligent”, “those who can do math are clever” and “math is a sign of intelligent”.

**Question 7: Have you have any positive memory about math? If so, please give some detail.**

**Figure 9. Q7:** Have you have any positive memory about math? If so, please give some detail

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Codes** | **Examples** | **Total Frequency** |
| 1 | I have no any positive memory |  | 160 |
| 2 | Being successful | One day I got the highest grade in math exam | 99 |
| 3 | Solving a problem at blackboard | One day I had solved the problem teacher wrote at blackboard and my peers had applauded me | 6 |
| 4 | Liking a topic of math | When I was 10th grade, the first topic was probability and I liked it so much | 3 |
| 5 | Teacher attitudes | I thought that I couldn't do math. But when I was a freshman in high school our math teacher made me love math and then math became my popular course.  | 50 |

Results of Q7 clarified that almost half of the participants have no any positive experience or memory with math. Considering the positive experiences, most of them include being successful at math, to illustrate getting a high point at math exam. Teachers’ positive attitudes also help students develop positive relations with math. Consequently, in order to like math, it can be concluded that students need to experience the sense of being successful and positive teacher behaviors.

**Question 8: Please write three words, when you remember mathematics jump into your mind immediately.**

**Figure 10. Q8:** Please write three words, when you remember mathematics jump into your mind immediately.

Based on Figure 10 three categories of words can be derived from the responses of Q8: 1. Positive words (green bar), 2. Negative words (red bars), 3- Neutral words (blue bars) and 4- Either positive or negative words (brown bars) Positive words are fun, funny, joyful and wonder and the frequency of them is calculated as 23. On the other hand, failure, confusing, fear, anxiety, difficultness, tension, boring, crying, anger and pain are examples for negative words. The frequency for this category is 357. The third category, the neutral words, is those that have no any emotional meaning or part. For example, geometry, math problems, operations and numbers. The frequency is 285. Lastly, the third category contains the words can be evaluated either positive or negative based on the participants’ experiences. Teachers and intelligence, intelligent, brain and logic are those words. In case of a conflict with math teacher, this word may have a negative sound or if the participants have a myth like “math require being intelligent” then the word of intelligent have a negative sound also. The frequency is found as 48 for this category.

**Discussion**

The findings clarified that participants mostly experienced their first adverse memory related with math during primary and secondary grades, namely ages between 6 and 13. The possible explanations for this results may be that when the students attend the school in primary level, they face with classroom rules, an authority figure (teacher) organizing them apart from games or game age of preschool years. Such a shift or change in life may yield an anxiety. While the mathematical skills expected to be gained by students are 4 numeration skills in primary level; it become more complicated in secondary level and also this may be a source of anxiety and forced students to experience adverse memories with math.

The content analysis of the adverse memories about math revealed that these memories are about failure, teachers’ attitudes and sense of difficulty about math predominantly. A supportive finding was derived from the research by Alkan (2018) and in her study on reviewing math anxiety in Turkish literature she pointed out that mathematics anxiety is consequence of self-efficacy and lack of parents and teachers’ support. However it is unknown which the main cause is. In other words, teachers’ attitudes may trigger a sense of difficulty; a sense of difficulty may prevent students to try to cope with math or a failure may force students to develop negative attitudes toward math or math teachers.

The students’ thoughts when they saw a difficult math problem are categorized as accepted inefficacy (false premises about his/her own math competency), anger, hopelessness, self-blaming, chaos with math knowledge (not to know how to use math knowledge to solve a problem). Similar findings are provided in various researches (Konca, 2008; Günhan ve Başer, 2007). These thoughts or cognitive patterns generally seem to be negative. Cognitive psychology focuses on the effects of irrational or negative thinking styles on feelings and behaviors of individuals. To this theory, such irrational ways of thinking yield negative feelings such as anxiety, anger, blame etc. Then in order to cope with these feelings, the individuals may generate dysfunctional behaviors such as depression, avoiding, blaming others or self. A cognitive psychology rooted empirical intervention Cognitive Behavioral Therapy (CBT) is evaluated as one of the promising interventions to lessen math anxiety (Hembree, 1990; Karimi & Venkatesan, 2009; Lyons & Beilock, 2010; Maloney, 2012; Zettle, 2003)perihan biçer lee

The students’ feelings when they saw a difficult math problem are categorized as anxiety, fear, panic, hopelessness and helplessness. Using cognitive psychology lenses these results are expected, because these negative feelings may be the results of the negative cognitions about math discussed in the previous paragraph. This type of anxiety is labeled as mathematics anxiety in literature and “Mathematics anxiety can be defined as the emotional reaction of fear, tension, helplessness, and mental disorganization when dealing with a mathematics problem” (Ashcraft, 2002; Fennema & Sherman, 1976; Zettle, 2003, as cited in Biçer, Perihan and Lee, 2020)

The participants attribute negative adjectives again when they evaluate their math identity. Namely, unskillful, untalented, inefficient, unsuccessful and not intelligent are the adjectives widely hold by them. These adjectives are the summaries of their math identity. In other words, the students’ all thoughts, feelings, behaviors, efforts to be successful at math, interactions with teachers, peers and parents about math build a construction and the term used for this construction is math identity. It is about how a student see her/him relationship with math. Similar findings are also proved by various studies (Zimmermann, 2000; Kolacinski, 2003 and Ramirez, Shaw and Maloney, 2018).

Many of the participants had no any positive memory about math. Psychologically, this may yield a chronic stress on students. Because having no any positive moments may kill the sense of hopeless and trigger depression and anxiety. Those who have such a memory revealed that in this memories they experienced a moment of being successful at math and positive attitudes of teachers, admiring, praising and glorifying. Therefore in order to help students love and learn mathematics the positive behaviors of teachers have an essential role. In the same vein, Erden and Akgul (2010) pointed out that math anxiety and teacher support are significant predictors of math success.

Finally using a metaphorical approach, the words or adjectives come to in students’ mind may give some important clues to open their inner math world’s doors. Unfortunately, these are negative words. Difficult, difficultness, hard sledding at math, fear, anxiety, stress and boring are most frequented words coming into their mind when they remember mathematics. However researches proved that math anxiety develops in students because of the teaching methods or ways not of difficultness of content or topics (Williams, 1988).

In conclusion, the students failing at math have negative thoughts, feelings and behavior related with learning and studying mathematics. Having some myths or irrational beliefs about math; feeling negative emotions like anxiety, fear, hopelessness, helplessness, anger and self-blaming and avoiding to try to learn or succeed math seem to be main components of participants’ actual mathematical identity. A special focus should be spent on adverse early mathematics memories of students.

**Suggestions**

Although Turkish literature on math anxiety provides some studies, most of them are correlational or descriptive researches. In these researches the prevalence of math anxiety and the relationship with certain variables is investigated. No study to develop an intervention program to help students cope with their math anxiety has been witnessed. Therefore, development of such psycho-educational programs is an urgent need.

These programs may include group or individual counseling sessions focused on remembering early adverse memories related with math, erasing these memories analyzing them in a more realistic way, detecting biased assumptions or myths about mathematics, processing feelings of anxiety, fear and pain related with math failure and developing a positive math identity.

Additionally math teachers have a tremendous effect on students’ attitudes toward mathematics in general or specifically toward a certain topic like equations or algebra. The findings suggest that a more positive teaching and relating way should be employed by teachers. It is vital especially at the moment of failing during solving a math problem in front of peers. The sense of being humiliated by teachers or peers may trigger a poor self- esteem related with math and consequently a math anxiety or fear. Therefore, teachers’ not focusing on true answer strictly, instead praising the reasoning while solving the math problem may be more effective. School counselors may organize guidance sessions to inform teachers about the findings of the studies on math anxiety.

Moreover, the interventions to cope with math anxiety should focus on students, teachers and peers using a systemic perspective lenses. In order to lessen the sense of being humiliated by teacher or peers, micro communications skills training may be presented to those group to help them how to react to a students who reached a false solution for a math problem in a healthier way. To illustrate, the teacher may declare to all students that any attempt by them to solve a problem on blackboard and logical reasoning rather than true solution will be considered and graded.

Lastly, there is a need for more research to develop several interventions based on various theoretical backgrounds to cope with math fear or anxiety. For example EMDR (Eye Movement Desensitization and Reprocessing) is a promising tool to erase the bad memories and install strengths to heal traumatic events triggering anxiety and panic. Gestalt Therapy is an effective approach to process unfinished psychological businesses and unexplained feelings related with math. Self-determination theory may be a functional strategy to help students increase their self-efficacy level. In doing so, the counselors or counselor educators may work with mathematician in an interdisciplinary fashion.

**References**

Adal, A. & Yavuz, İ. (2017). Ortaokul öğrencilerinin matematik öz yeterlik algıları ile matematik kaygı düzeyleri arasındaki ilişki [The relationship between mathematics self efficacy and mathematics anxiety levels of middle school students]. *International Journal of Field Education*, 3(1), 20-41.

Alkan, V. (2018). A Systematic review research: ‘Mathematics anxiety’ in Turkey. *International Journal of Assessment Tools in Education*, Vol. 5, No. 3, 567–592.

Ashcraft, Mark H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current Directions in Psychological Science,* 11(5), 181-185.

Avcı, E., Coşkununcel, O. & İnandı, Y. (2011). Attitudes of twelfth grade students towards mathematics. *Mersin University Journal of the Faculty of Education*, Vol. 7, Issue 1, pp.50-58.

Baloglu, M., & Koçak, R. (2006). A multivariate investigation of the differences in mathematics anxiety. Personality and Individual Differences, 40(7), 1325–1335. h

Dede, Y., & Dursun, Ş. (2008). İlköğretim II. kademe öğrencilerinin matematik kaygı düzeylerinin incelenmesi (Investigation of math anxiety levels of secondary students). *Gazi Üniversitesi* *Eğitim Fakültesi Dergisi*, 11(2), 295-312.

Demir, S., & Durmaz, M. (2018). Opinions of elementary math teachers about math anxiety and their intervention methods. *Academia Eğitim Araştırmaları Dergisi*, 3(1), 17-27.

Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics anxiety: What have we learned in 60 years? Frontiers in Psychology, 7, Article 508

Erden, M. & Akgul, S. (2010). Predictive power of math anxiety and perceived social support from teacher for primary students‟ mathematics achievement. *Journal of Theory and Practice in Education*, 6, 3-16.

Cantürk, G.B. & Başer, N.. (2007). The development of self-efficacy scale toward geometry. *Hacettepe* *Üniversitesi Eğitim Fakültesi Dergisi*, 33(33), 68-76

Hembree, R. (1990). The nature, effects and relief of mathematics anxiety. *Journal for Research in Mathematics Education,* 2, 33-46. doi: 10.2307/749455.

Hsiu-Zu, H., Şentürk, D, Lam, A.G. & Zimmer, J.S (2000). The affective and cognitive dimensions of math anxiety: A cross-national study. *Journal for Research in Mathematics Education*. vol. 31. (3): 362-380.

House, D. J. (2006). Mathematics beliefs and achievement of elementary school students in Japan and the United States: Results from the third international mathematics and science study. *The Journal of Genetic Psychology*. c.167. s. 1: 31-45.

Kolacinski, J. F. (2003). Mathematics anxiety and learned helplessness: A Doctoral Treatise. Doctoral Dissertation, University of Miami.

Konca, Ş.. (2008). Yedinci sınıf öğrencilerinin matematik kaygı nedenlerinin bazı değişkenler açısından incelenmesi. (Yayımlanmamış Yüksek Lisans Tezi). (Examining the Relationship Between Math Anxiety of 7th Grade Students and Some Variables, Unpublished Ms Thesis) Yüzüncü Yıl Üniversitesi, Van, Turkey.

Ma, X. and Kishor, N. (1997). Attitudes toward self, social factors, and achievement in mathematics: Meta-analytic review. *Educational Psychology Review*. c. 9. s. 2: 89-120.

Maloney, E. A., & Beilock, S. L. (2012). Math anxiety: Who has it, why it develops, and how to guard against it. *Trends in Cognitive Sciences*, 16, 404-406.

Mason, Lucia. 2003. High school students’ beliefs about math, mathematical problem solving, and their achievement in math: A cross-sectional study. *Educational Psychology*, c. 23. s. 1: 73-85.

Mcleod, D. B. (1992). Research on Affect in Mathematics Education: A Reconceptualization. Handbook opf Research on Mathematics Teaching And Learning. ed. Douglas A. Grouws. New York: Macmillan: 575-596.

Medikoğlu, O. (2020). Investigation of the relationship between primary school students' mathematics self-efficacy sources and mathematics anxiety levels. *Eğitim Kuram ve Uygulama Araştırmaları Dergisi* 2020, Cilt 6, Sayı 1, 35-52

Miller, H., & Bichsel, J. (2004). Anxiety, working memory, gender, and math performance. Personality and Individual Differences, 37(3), 591–606.

Nazlıçiçek, N. (2007). A modeling study to explain mathematics achievement of tenth grade students. *Unpublished Doctoral Dissertation.* Yıldız Teknik University, İstanbul.

Biçer, A., Perihan, C. & Lee, Y. (2020). A meta-analysis: the effects of CBT as a clinic- & school-based treatment on students’ mathematics anxiety. *International Electronic Journal Of Mathematics Education*, Vol. 15, No. 2

Ramirez, G., Shaw, S. T., & Maloney, E. A. (2018). Math anxiety: Past research, promising interventions, and a new interpretation framework*. Educational Psychologist*, 53, 145-164.

OECD (2018) PISA 2018 Results, derived from <https://www.oecd.org/pisa/publications/pisa-2018-results.htm> at October, 2021.

Taşdemir, C. (2015). Investigation of math anxiety levels of secondary school students (Ortaokul öğrencilerinin matematik kaygı düzeylerinin incelenmesi). *Journal of Life and Science, 5*(1), 1-12.

Toptaş, V. and Gözel, E. (2018). The content analysis of the post-graduate theses concerning maths anxiety. *Eğitim Kuram ve Uygulama Araştırmaları Dergisi*, Cilt 4, Sayı 3, 136-146.

Tuncer, M. & Yilmaz, Ö. (2016). An evaluation of the secondary school students' opinions on attitudes and anxieties towards mathematics class*. KSÜ Journal of Social Sciences* Vol 13,2.

Yıldırım, A. & Şimşek, H. (2006). *Qualitative Research Methods*, Seçkin Publishing, Ankara, Turkey.

Zimmerman, B. J. (2000). Self-Efficacy: An Essential Motive to Learn. *Contemporary Educational Psychology*, 25, 82-91. doi: 10.1006/ceps.1999.1016

Williams, W. Virginia. (1988). Answers to questions about math anxiety. *School Science and Mathematics,* 88(2), 95-104.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and Procedures for Developing Grounded Theory* (2nd ed.). Thousand Oaks, CA: Sage