# Mathematics Anxiety and the Influencing Factors among Junior High School Students in Yogyakarta, Indonesia

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## *Abstract*

*Over the past decade, several researchers have documented the results of their research on the connection between mathematics anxiety and poor mathematical abilities of students. Therefore, the study of mathematical anxiety and its causal factors becomes an important research area. This study aims to determine the level of mathematics anxiety and the influencing factors among junior high school students in Yogyakarta. It is a descriptive study with quantitative data about mathematics anxiety in junior high schools in Yogyakarta. With the use of random sampling technique, 2163 students from 44 public and private schools in Yogyakarta were chosen to participate in the study. A mathematics anxiety scale and a questionnaire of factors influencing mathematics anxiety were utilized in the study. The data were analysed using descriptive statistical analysis and the findings indicate mathematics anxiety of junior high school students in Yogyakarta is manifested mostly in cognitive symptoms. The most significant factor influencing students' mathematics anxiety is home, i.e. interactions with parents and siblings, and the second factor is the classroom. Collaboration between various school stakeholders is required to reduce students' mathematics anxiety.*

**Key words**: *collaborative counselling; junior high school students; mathematics anxiety; mathematics anxiety factors.*

## Introduction

The development of technology in recent decades is based on one of the universal sciences: mathematics (Stoet & Geary, 2018; Prahmana et al., 2019). Students need to learn mathematics so they develop the ability to think logically, analytically, systematically,

critically and creatively, as well as the ability of cooperation that is useful in everyday life (Lince, 2016; Apino & Retnawati, 2017; Bussotti, 2019). However, the facts show that learning mathematics requires various improvement efforts. The data from the Ministry of Education and Culture of Indonesia shows a decrease of the average score in the 2018 National Examination in Mathematics in junior high schools. The average mathematics score in the 2018 National Examination of junior high school students from state schools was 53.42, while this result was 56.27 in 2017 (Putri, 2018). Therefore, it is obvious that something is affecting student confidence in learning mathematics, although they understand that mathematics is important in life.

Anita (2014) conducted a research involving 80 students from Bandung junior high schools, which showed that the increase of anxiety in mathematics learning, mathematics tests and numerical calculations leads to weakening the ability of making mathematical connections, and vice versa. Furthermore, Mutawah and Ali (2015) explain that mathematics anxiety is influenced by students' psychological conditions, which affects their learning outcomes. The level of mathematics anxiety is significant, especially for students in beginning grades (Cargnelutti et al., 2017). This is due to the expected goal of increasing the learning outcome.

The success of student learning in school is the responsibility of subject teachers as well as school counsellors (Bore et al., 2013). Effective guidance and counselling services will be carried out well if there is cooperation between subject teachers and other related parties, among others, overall teaching and other education staff in schools (Schmidt, 2003). Therefore, as an effort to reduce students' anxiety in learning mathematics, collaborative endeavours are needed on the part of mathematics teachers and counsellors in schools.

Collaborative group counselling is a form of counselling realized through involving subject teachers in alleviating the experienced students' problems in order to optimize their learning achievement and development at school (Schmidt, 2003; Bore et al. 2013; Nakimuli-Mpungu et al., 2013). The collaborative group counselling process emphasizes dynamic interpersonal communication by focusing on thinking and behaviour used in joint problem solving based on mutual trust and understanding between subject teachers, counsellors and students (Schmidt, 2003; Jacobs, 2009; Myrick, 2011). Thus, this study aims to determine the level of mathematics anxiety and the influencing factors among junior high school students in Yogyakarta. Moreover, its goal is to produce a collaborative model of learning mathematics via group counselling services in order to reduce students' mathematics anxiety.

## Mathematics anxiety

Hlalele (2012) defines anxiety with a general term for several disorders that cause nervousness, fear and worry. Lack of self-confidence in students bears fear of the inability to do math, the perception of mathematics being too hard, or frequent fear of failure (Mutodi & Ngirande, 2014). Furthermore, Ramirez et al. (2016) explain that

mathematics anxiety can cause individuals to have negative thoughts in maintaining superior performance in mathematics. On the other hand, Harari et al. (2013) explore the nature of mathematics anxiety on a sample of 106 first grade students. Their results show that mathematics anxiety levels are not different across gender and background.

Mathematics anxiety is defined as a negative reaction to mathematics and situations related to mathematics achievement or competence. Mathematics anxiety consumes working memory resources and consequently reduces the resources needed to solve complex mathematical problems (Ashcraft & Ridley, 2005). Students who have higher cognitive capacity but at the same time experience mathematic anxiety will avoid using advanced problem-solving strategies (Ramirez et al., 2016) and thus have lower marks in mathematics. Therefore, students with higher cognitive capacity and the feeling of mathematical anxiety perform worse than those with lower cognitive capacity without mathematical anxiety.

Nevid et al. (2005) classify anxiety symptoms in three types: physical symptoms - nervousness, tremors, sweating, difficulty breathing, rapid heartbeat, feeling weak, fever, irritability and feeling upset; behavioural symptoms - avoidance, whole body trembling, clinging and dependent behaviour; cognitive symptoms - worrying about something, feeling disturbed by fear of something bad expected to happen in the future, belief that something frightening will happen soon, fear of the inability to overcome problems, mental confusion and difficulties in concentration. Furthermore, Nevid et al. (2005) explained dependent behaviour as behaviour of students who depend on others whenever they are doing mathematical tasks, e.g. feeling unable to solve mathematical tasks or problems alone. Students with poor learning autonomy have high learning anxiety (Kozan et al., 2016). High learning anxiety in students has an impact on learning and effects low self-efficacy (Ahmad et al., 2012). In addition, people who experience anxiety are tense, misunderstand information and have difficulties with memory and low motivation (Vitasari et al., 2010). Therefore, these variables become important in understanding students' mathematical anxiety.

Some differences can be observed between physical symptoms and behavioural symptoms in mathematical anxiety. Physical symptoms are also called somatic symptoms, and they are related to the condition and physical or bodily functions of a person (Conley, 2006). Somatic symptoms are manifested as a sort of restlessness, tremors, heavy sweating, difficulty breathing, rapid heartbeat, feeling weak and freezing (Nevid et al., 2005). Stuart (2014) refers to these physical symptoms as physical tension, while Blackburn and Davidson (1995) regard them as biological tension. Behavioural symptoms are an individual's response via behavioural actions originating from the outside as well as from within (Feist, 2012). Behaviour that occurs as a response to mathematical anxiety entails avoidance, body trembling and dependent behaviour (Nevid, et al. 2005). It is important to note that tremors are regarded as a somatic/physical symptom of anxiety because it is manifested more as a physical reaction.

Some factors can cause students to experience mathematics anxiety. Guita and Tan (2018) suggested that students' mathematics anxiety can occur due to the following: lack

of mastery of basic concepts and skills, lack of problem-solving and critical thinking skills, diverse student behaviour and inappropriate teaching skills and approaches in dealing with students in mathematics lessons. Besides, students' mathematics anxiety is related to students' topic preference and is associated with students' gender (Oyenekan Dotun et al., 2018). Furthermore, mathematics anxiety can be caused by various factors and perpetuated in the home, society and classroom (Shields, 2005; Whyte & Anthony, 2012).

Mathematics anxiety experienced by students has an impact on students' learning development. Yamani et al. (2018) argue that mathematics anxiety can affect cognitive and affective processes; it has an impact on students' success rate and a detrimental effect on their future career and professional development.

Some methods can be used to reduce mathematics anxiety experienced by students. Davis and Khan (2018) explain that the strategy of developing ways of learning in authentic reality can reduce students' mathematics anxiety. In addition, as educators, mathematics teachers can collaborate with school counsellors in overcoming students' personal, social, academic and career planning problems (Myrick, 2011). Collaborative learning and group counselling services entail collaboration between subject teachers and school counsellors, which is very useful in optimizing student development.

## Methods

### General background

This research was implemented based on a descriptive model with quantitative data about mathematics anxiety of junior high school students in Yogyakarta. It was a preliminary study implemented with the aim to produce a collaborative model of learning mathematics with group counselling services in order to reduce mathematics anxiety in students.

### Participants

The participant sample in this study included 2163 students chosen by random sampling technique 44 public and private schools from five districts in Yogyakarta, namely Bantul, Yogyakarta, Sleman, Kulonprogo and Gunungkidul. The research sample included 1122 male and 1041 female students.

### Instrument and procedures

This study was done with the use of Mathematics anxiety scale and the Questionnaire of factors influencing mathematics anxiety. The reliability of the scale of mathematics anxiety is 0.94 and of the questionnaire of factors that affect mathematics anxiety is 0.82. The reliability tests of the two instruments were analysed using the Alpha Cronbach formula. Mathematics anxiety scale encompasses physical symptoms, behavioural symptoms, cognitive symptoms and low motivation as indicators of mathematical anxiety. Questionnaire of factors influencing mathematics anxiety reveals indicators

in the home, society and classroom. The collected data were analysed via methods of descriptive statistics.

Mathematics anxiety scale questionnaire covering aspects of physical symptoms, behavioural symptoms and cognitive symptoms (Nevid et al. 2005) was modified with indicators of low mathematics learning motivation (Vitasari et al. 2010; Zakariya, 2018). This modification resulted in Mathematical anxiety scale questionnaire covering four aspects: physical symptoms, behavioural symptoms, cognitive symptoms and low motivation. This scale was used to examine mathematics anxiety of 2163 junior high school students in Yogyakarta.

Physical symptoms are also called somatic symptoms and they entail a person's condition and physical or bodily functions (Conley, 2006). Somatic, i.e. physical symptoms of anxiety include restlessness, shaking limbs, heavy sweating, difficulty breathing, rapid heartbeat, feeling weak and chills (Nevid et al., 2005). Stuart (2006) regards these physical symptoms as physical tension, while Blackburn and Davidson (1995) refer to them as biological tension. Therefore, this study also considered the following as indicators of physical symptoms: anxiety, tremors, heavy sweating, difficulty breathing, rapid heartbeat, feeling weak and chills.

Behavioural symptoms are responses of an individual in the form of behaviour to stimuli originating from outside and from within (Feist, 2012). This behaviour is based on the attitude maturing in a person experiencing mathematical anxiety, for example, he/she is not confident enough to do the requested or is reluctant to do it (Cooke & Hurst, 2012). In addition, behaviour that appears to be a response to mathematical anxiety entails avoidance, trembling of the whole body, attached and dependent behaviour (Nevid et al., 2005). Therefore, this study regarded avoidance, shaking and dependent behaviour as behavioural symptoms.

Cognitive symptoms are related to changes in a person's cognitive functioning when dealing with mathematics, such as not being able to think clearly or forgetting things that can usually be remembered (Cooke & Hurst, 2012). Moreover, cognitive symptoms of anxiety can also entail the following: memory blocking (Vitasari et al. 2010), perception of difficulty (Zakariya, 2018), worrying about something, feeling disturbed by fear of something that happens in the future, belief that something bad will happen soon, fear of the inability to overcome a problem, the feeling of being mixed up or confused, and difficulty with concentration (Nevid et al., 2005). Therefore, the indicators of cognitive symptoms in this study are: perception that mathematics is difficult, disturbed feelings or fear of something bad expected to happen in the future, belief that something frightening will happen soon, fear of the inability to overcome problems, mixed up thoughts or feeling of confusion (memory blocking), difficulty with concentration and worrying about something.

Motivation is defined as a condition that drives a person to do certain activities in order to achieve a goal (Peters, 2015). Learning motivation entails students' willingness, needs, desires and enthusiasm in participating and being successful during the learning

process (Moenikia & Zahed-Babelan, 2010; Yunus & Ali, 2009). On the other hand, low motivation is one of the characteristics of students who experience mathematical anxiety (Moenikia & Zahed-Babelan, 2010; Vitasari et al. 2010; Zakariya, 2018), i.e. high academic motivation affects low mathematics anxiety of students (Ali & Hassan, 2019; Moenikia & Zahed-Babelan, 2010). Furthermore, Peters (2015) states the following as the characteristics of people who possess learning motivation: the desire to succeed, enthusiasm, a need for learning, having hopes and ideas of the future, getting awards in learning, doing interesting activities, and the existence of a conducive learning environment. Thus, this study regards the following as indicators of low motivation: lack of desire for mathematical success, not recognising the need to learn mathematics, lack of hope for the future, and poorly pronounced interest in learning mathematics.

Two instruments were utilized in this study: Mathematics anxiety questionnaire and the Questionnaire on factors influencing mathematics anxiety. The mathematical anxiety instruments were developed based on indicators of mathematical anxiety from several studies, including the following:

1 Cooke and Hurst (2012) explain that indicators of mathematics anxiety include: mathematics knowledge / understanding of phenomena and things such as sudden emergence of thoughts of not knowing enough about mathematics; somatic symptoms that are associated with an individual bodily state, for example, body sweats or heart races; cognitive symptoms that entail changes in one's cognition when dealing with mathematics, such as not being able to think clearly or forgetting things that can usually be remembered; and attitude-related symptoms entailing attitudes that arise when a person has mathematical anxiety, for example, one is not confident enough to do the thing requested or is reluctant to do it.

2 Nevid et al. (2005) classify anxiety symptoms into three types, namely physical symptoms, behavioural symptoms and cognitive symptoms.

3 Das and Das (2013) categorize mathematical anxiety symptoms in three groups: physical symptoms, psychological symptoms and behavioural symptoms.

4 Vitasari et al. (2010) mention the following as the characteristics of people who experience anxiety: feelings of tension, misunderstanding of information, memory blocking and low motivation.

5 Zakariya (2018) explains that the characteristics of mathematical anxiety include anxiety in learning mathematics, the perception of difficulty and motivation.

6 Low motivation becomes one of the characteristics of students who experience mathematics anxiety (Moenikia & Zahed-Babelan, 2010; Vitasari et al., 2010; Zakariya, 2018).

7 High academic motivation is connected with low mathematics anxiety of students (Ali & Hassan, 2019; Moenikia & Zahed-Babelan, 2010).

Based on mathematical anxiety indicators from the studies of the aforementioned researchers, this study utilized Mathematics anxiety questionnaire whose design is based on indicators of physical symptoms, cognitive symptoms, behavioural symptoms and low motivation.

Furthermore, the second instrument is a questionnaire related to factors that influence mathematical anxiety, which was developed based on the following research:

1 Whyte and Anthony (2012) explain that factors contributing to mathematical anxiety experienced by students can come from home, society and classroom.

2 The involvement of parents and friends in learning techniques can be a factor influencing student participation in learning mathematics (Wahid et al., 2014).

3 Mathematical anxiety can be caused by environmental factors such as negative experiences with parents or teachers (Aarnos & Perkkilä, 2012).

4 Trujillo and Hadfield (1999) explained that the factors causing mathematical anxiety in students include personality factors (psychological or emotional), environmental or social factors, and intellectual factors.

Based on the research results of these experts, the focus of this study is on exploring environmental and external factors that affect students' mathematical anxiety. Thus, home, society and classroom serve as the basis for measuring the factors influencing students' mathematical anxiety, which can therefore be used as a consideration in determining the type of treatment that aims at reducing mathematical anxiety in students by improving environmental conditions.

Aspects and indicators of Mathematics anxiety scale and causal factors of mathematics anxiety used in this study are presented in Table 1. This instrument consists of 92 questions that the respondents answered with the aim of finding out the level of their mathematics anxiety and the factors causing it.

Table 1

*Aspects and indicators of Mathematics anxiety scale*

| Aspects | Indicators | Favourable | Unfavourable |
|---------|-----------|------------|--------------|
| | Mathematics anxiety | | |
| Physical symptoms | Nervousness | 1, 2 | 5, 6 |
| | Tremors, sweating, difficulty breathing, rapid heartbeat, feeling weak, fever | 3, 4 | 7, 8 |
| Behavioural symptoms | Avoidance | 9, 10 | 15, 16 |
| | Whole body trembling | 11, 12 | 17, 18 |
| | Dependent behaviour | 13, 14 | 19, 20 |
| Cognitive symptoms | Worrying about something | 21, 22 | 35, 36 |
| | Feeling disturbed by fear of something that might happen in the future | 23, 24 | 37, 38 |
| | Belief that something frightening will happen soon | 25, 26 | 39, 40 |
| | Fear of the inability to overcome problems | 27, 28 | 41, 42 |
| | The feeling of being mixed up or confused (memory blocking) | 29, 30 | 43, 44 |
| | Difficulties with concentration | 31, 32 | 45, 46 |
| | The perception of mathematics being difficult | 33, 34 | 47, 48 |

| Aspects | Indicators | Favourable | Unfavourable |
|---|---|---|---|
| Low motivation | Lacking a passion for success in mathematics | 49, 50 | 57, 58 |
| | Feeling a lesser need to learn mathematics | 51, 52 | 59, 60 |
| | Lack of hope for the future | 53, 54 | 61, 62 |
| | Less interested in participating in activities | 55, 56 | 63, 64 |
| **Factors influencing mathematics anxiety** | | | |
| Home (Parents and Siblings) | Parents denounce children's math grades | 65 | 70 |
| | Parents regard the child's mathematical abilities as poor | 66 | 71 |
| | Parents let children stop trying when children experience frustration in mathematics | 67 | 72 |
| | Parents insisting on mathematics being difficult | 68 | 73 |
| | Parents require excessive mathematics success in children | 69 | 74 |
| Society | Self-efficacy (boys are better in mathematics than girls) | 75 | 79 |
| | Social reinforcement to hate mathematics | 76 | 80 |
| | Social stereotype (language ability is more important and socially acceptable than mathematics ability) | 77, 78 | 81, 82 |
| Classroom | Mathematics teacher using traditional approach to classes | 83, 84, 87 | 88, 89, 92 |
| | Classroom culture | 85, 86 | 90, 91 |

## Results

The students' mathematics anxiety was described by analysing the results of the scale administered to 2163 students from 44 junior high schools. The sample included 1122 male students and 1041 female students aged 13-14. The results of data analysis were categorized into five levels, according to the intensity of student anxiety: very high, high, medium, low and very low. As many as 43,78% of the participants belong to medium category, 7.44% to high category, and 0,60% to very high category. This data shows that most students in junior high schools in Yogyakarta experience mathematics anxiety and require curative efforts from various parties to overcome the problem. The categorization of students' mathematics anxiety levels are presented in Table 2.

Furthermore, the results of data analysis showed that the aspects of mathematics anxiety experienced by many students in junior high schools in Yogyakarta were manifested in cognitive symptoms, amongst others, with the average value of 2.33 items. Cognitive symptoms entail worrying about something, fear of something that might happen in the future, the belief that something frightening will happen soon, fear of the inability to overcome problems, mental confusion and difficulty with concentration (Nevid et al., 2005). Furthermore, aspects of mathematics anxiety also

entail physical symptoms, with an average value of 2.24 items; behavioural symptoms, with an average value of 2.23 items; and low motivation, with an average value of 2.14 items. These aspects of mathematical anxiety in students are presented in Figure 1.

Table 2

*Categorization of students' mathematics anxiety levels in Yogyakarta, Indonesia*

| No | Category | Number | Percentage |
|----|----------|--------|------------|
| 1 | Very High | 13 | 0, 60 % |
| 2 | High | 161 | 7, 44 % |
| 3 | Medium | 947 | 43, 78 % |
| 4 | Low | 882 | 40, 78 % |
| 5 | Very Low | 160 | 7, 40 % |
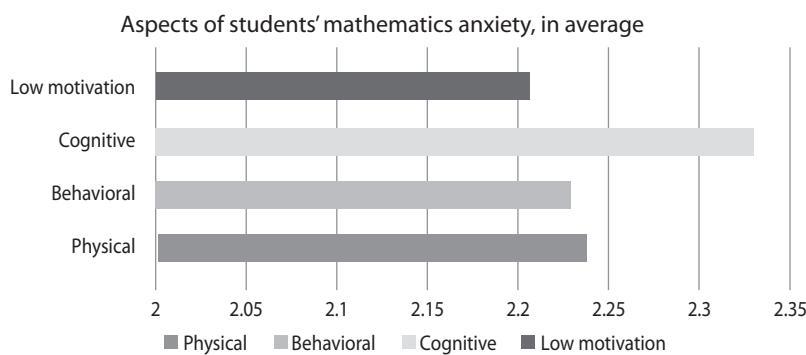


*Figure 1.* Aspects of students' mathematics anxiety, in average

This study also found that mathematics anxiety experienced by male students is higher than mathematics anxiety in female students. The mean values of mathematics anxiety for male and female students were respectively 130.68 and 121.30. In addition, data analysis showed that the average mathematics anxiety level of both male and female students was found in the aspect of cognitive symptoms at 2.40 and 2.26, respectively. The comparison of average values of mathematics anxiety aspects in male and female students are presented in Figure 2.
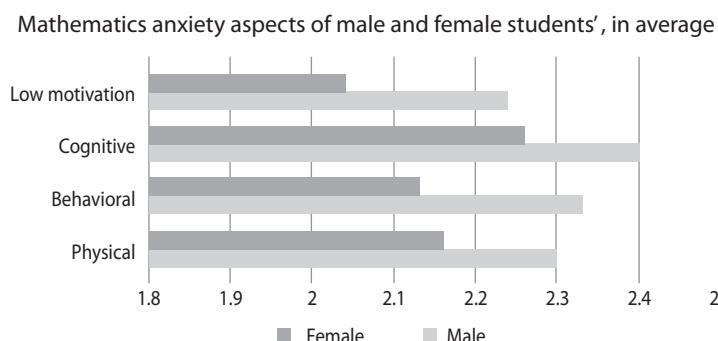


*Figure 2.* Mathematics anxiety aspects of male and female students, in average

To determine the factors influencing mathematics anxiety among 2163 junior high school students in Yogyakarta, we used the Questionnaire on factors influencing mathematics anxiety, namely home, society and classroom (Whyte & Anthony, 2012). These factors were delineated by analysing the results of the scale administered to 2163 students from 44 junior high schools: 1122 male students and 1041 female students.

The results of data analysis proved the home factor as the most influential in students' mathematical anxiety, with a mean value of 2.14. The home factor entails the influence of parents and siblings (Whyte & Anthony, 2012). The second factor affecting student anxiety is the classroom, with an average value of 2.13, and the third factor is society, with a mean value of 2.02. The average values of the factors influencing mathematics anxiety are presented in Table 3.

Table 3

*Factors affecting mathematics anxiety in students in Yogyakarta, Indonesia*

| No | Aspects | Average |
|----|---------|---------|
| 1 | Home | 2,14 |
| 2 | Society | 2,02 |
| 3 | Classroom | 2,13 |

There are differences in the factors affecting mathematics anxiety in male and female students. The most influential factor of mathematics anxiety in male students is home, at a mean of 2.24, while the most influential factor of mathematics anxiety for female students is the classroom. The comparison of these factors regarding male and female students is presented in Figure 3.

The factors influencing mathematics anxiety in male and female students'
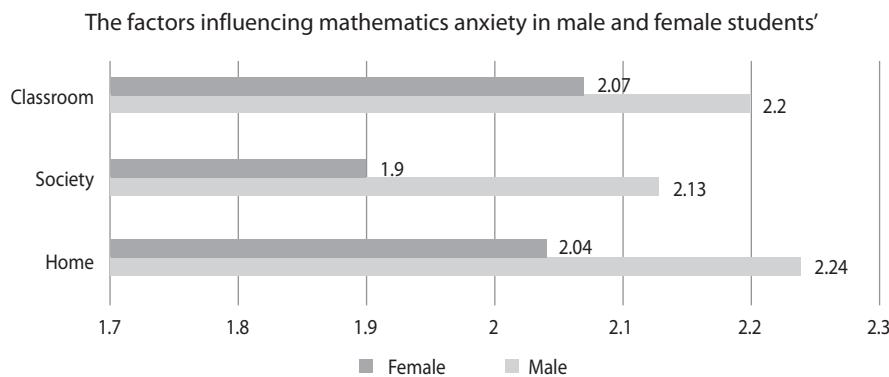


*Figure 3.* Factors influencing mathematics anxiety in male and female students

## Discussion and conclusions

The results of this study indicate that the highest students' mathematics anxiety is manifested in the cognitive aspect: when facing math lessons or problems, students felt worried or feared the future. That fear in turn lessened their mental ability, which

made it hard for them to focus and concentrate. In line with the study conducted by Núñez-Peña and Suárez-Pellicioni (2014), some students were preoccupied with intrusive thoughts generated by high levels of anxiety. In other references, it is stated that mathematics anxiety creates memory barriers, which makes it hard for some students to remember lessons (Young et al., 2012).

The study also showed that mathematics anxiety among male students was higher than among female students. This is contrary to results of the study conducted by Devine et al. (2012) who found that female students in England experienced higher mathematics anxiety than male students. In addition, findings of this study are also different from the findings of the study conducted by Birgin et al. (2010) which indicate a negative correlation between mathematics anxiety and students' interest in scientific careers, regardless of their level of mathematical skills or gender.

This study also revealed that the most significant factor influencing mathematics anxiety in students in Yogyakarta is home, i.e. the influence of parents and siblings. This is in line with Soni and Kumari's research (2017) with students in grades five to ten in India which found a strong positive correlation between parents' and children's mathematics anxiety. In addition, a positive relationship is indicated between parental social interactions and child mathematics anxiety; however, this relationship is not easily explained by genetics alone (Maloney et al., 2015). Parents who believe that mathematics is useless and have low mathematical self-efficacy and low motivation to succeed in mathematics can reduce their children's motivation in learning so that the results of learning mathematics are decreased, which in turn makes these children more worried about mathematics (Maloney et al., 2015). Finally, this study also revealed that the factor influencing mathematics anxiety the most in girls was the classroom. A competitive classroom environment can create mathematics anxiety (Gunderson et al., 2012).

The results of this study can be used as a basis for further research with the aim of finding effective strategies of reducing mathematical anxiety. Mathematics teachers need to collaborate with school counsellors to develop student confidence in dealing with mathematics and reduce students' mathematical anxiety (Furner, 2017). Collaboration between mathematics teachers and counsellors in schools can be implemented in the form of collaborative service activities (Myrick, 2011). Furthermore, Tang (2016) states that collaboration that occurs between interested parties in educational programs and student development is one of the characteristics of effective school. Lastly, Dahir and Stone (2012) suggested that cooperation could be done with concerned parties in and outside school.

Regardings the school context, counsellors can work together with administrators, other teachers and students. They can implement teamwork with administrators in order to strengthen the school management. Collaboration with other teachers can be done via improving classroom management, creating comfortable conditions for students, consultation, case study, success story sharing, program promotion, and treatment for students who need special attention, such as remedial. Lastly, counsellors can collaborate with students in the form of peer services.

In order for school counselling to be effective in reducing students' mathematics anxiety, it is to be implemented in groups with a small number of members (Furner, 2017; Ruff & Boes, 2014). Group counselling is better than individual because group members need input from other members, they learn to listen and appreciate others rather than just talk. In the environment of adolescents, group counselling is better than individual counselling because adolescents usually prefer to talk to other teenagers over adults (Corey, 2012; Jacobs, 2009).

In the course of providing collaborative learning services and group counselling in reducing mathematics anxiety in students, attention needs to be paid to cultural context. Culture needs to be considered in providing counselling services (Corey, 2012). The learning culture in classrooms with students from different countries can influence mathematics anxiety in students (Hamza & Helal, 2013). Class culture becomes the standard of behaviour and norms that affect the style of classroom interactions. The process of learning mathematics is structured strictly, with no abundance of opportunities for discussion. Concentrating on finding the correct answers and hoping for quick answers can contribute to students' mathematics anxiety (Shields, 2005; Whyte & Anthony, 2012).

Culture has an influence on mathematics anxiety experienced by students (Luttenberger et al., 2018). Asian students tend to set high goals and evaluate themselves according to strict standards (Ashcraft & Moore, 2009). Besides, Asian students and parents tend to feel less satisfied with school performance than non-Asian students (Lee, 2009). Furthermore, culture is one of the factors that influence the occurrence of mathematics anxiety, in addition to the characteristics of the education system. Besides, parents and teachers' attitudes as well as the characteristics of students themselves also influence mathematics anxiety (Casad et al., 2015; Luttenberger et al., 2018). Therefore, cultural factors also need to be emphasized as an influence on student mathematics anxiety.

Understanding the conditions students live in and their cultural values becomes a consideration in the processes of learning and counselling (Corey, 2012; Gerstein et al., 2011; Huang, 2010). The cultural value of the local wisdom culture can be used as a basis for learning and counselling for students who come from multicultural environments (Darojah et al., 2018; Subali et al., 2015). In mathematics learning, a lot of things are very closely related to local wisdom in Indonesia, such as conditions, situations, culture and cultural heritage buildings in regions in Indonesia that are regarded as values of local wisdom (Setiawan et al., 2017). In addition, the counselling process that is based on cultural values and regional arts can be the basis of a collaborative model designed to overcome various student problems (Habsy, 2017). Therefore, the collaborative learning strategy and group counselling in reducing mathematics anxiety can be based on the values of local wisdom. It would be interesting for some future research to determine how local wisdom of Yogyakarta can contribute to reducing mathematics anxiety. The researchers who implemented this study are convinced that families and communities can also make a difference in terms of reducing anxiety in students.

The mathematics anxiety of junior high school students in Yogyakarta mostly manifests in cognitive symptoms. All 2163 students experienced mathematical anxiety of various intensity: very high, high, medium, low and very low. The most significant factor influencing students' mathematics anxiety is home, i.e. interactions with parents and siblings, and the second factor is the classroom. Furthermore, collaboration between various concerned parties in school is required to reduce mathematics anxiety amongst students. Cooperation between subject teachers, school counsellors and parents in reducing mathematics anxiety is essential in optimizing development and achievement in students' mathematics learning. Therefore, the results of this study can be used as a basis for devising a collaborative mathematics-learning model via group counselling with the aim of reducing students' mathematics anxiety.

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# Matematička tjeskoba i faktori utjecaja među učenicima niže srednje škole u Yogyakarti u Indoneziji

## *Sažetak*

*Tijekom prošloga desetljeća nekoliko je istraživača dokumentiralo rezultate svojih istraživanja veze između matematičke tjeskobe i slabih matematičkih sposobnosti učenika. Stoga proučavanje matematičke anksioznosti i njezinih uzročnika postaje važno područje istraživanja. U ovoj studiji nastojali smo utvrditi razinu matematičke tjeskobe i faktore utjecaja među učenicima nižih srednjih škola u Yogyakarti u Indoneziji. Istraživanje je zasnovana na deskriptivnom istraživačkom modelu s kvantitativnim podatcima o matematičkoj anksioznosti učenika u nižim srednjim školama u Yogyakarti. U istraživanju je sudjelovalo 2163 učenika iz 44 državne i privatne škole u Yogyakarti. Ovi su ispitanici odabrani tehnikom nasumičnoga uzorkovanja, a podatci su analizirani metodama deskriptivne statistike. Rezultati pokazuju da se matematička tjeskoba učenika niže srednje škole očituje većinom kognitivnim simptomima. Najznačajniji faktor koji utječe na matematičku tjeskobu je dom, tj. interakcije s roditeljima te braćom i sestrama, a drugi čimbenik je razred. Nužna je suradnja raznih relevantnih aktera u školama kako bi se smanjila matematička anksioznost učenika.*

***Ključne riječi****: faktori matematičke tjeskobe; matematička tjeskoba; suradničko savjetovanje; učenici niže srednje škole.*

## Uvod

Razvoj tehnologije u posljednjih desetljeća zasnovan je na jednoj od univerzalnih znanosti: matematici (Stoet i Geary, 2018; Prahmana i sur., 2019). Učenici trebaju učiti matematiku kako bi razvili sposobnost logičkoga, analitičkoga, sustavnoga, kritičkoga i kreativnoga mišljenja, kao i sposobnost zajedničkoga rada koji je koristan u svakodnevnom životu (Lince, 2016; Apino i Retnawati, 2017; Bussotti, 2019). Ipak, činjenice pokazuju da učenje matematike zahtijeva razna poboljšanja. Podatci Ministarstva obrazovanja i kulture Indonezije pokazuju da je prosječan rezultat na Nacionalnom ispitu iz matematike 2018. godine u nižim srednjim školama u Indoneziji oslabio. Naime, prosječan učenički rezultat na Državnom ispitu iz matematike 2018. godine bio

je 53,42, dok je 2017. godine taj rezultat bio 56,27 (Putri, 2018). Ovaj podatak ukazuje na prisutnost ometajućih faktora koji utječu na učeničko samopouzdanje u učenju matematike, iako učenici razumiju važnost matematike u životu.

Istraživanje koje je proveo Anita (2014) s 80 učenika niže srednje škole pokazalo je da porast tjeskobe u učenju matematike, matematičkim testovima i računanju dovodi do smanjenja učeničkih sposobnosti uspostavljanja matematičkih veza i obrnuto. Nadalje, Mutawah i Ali (2015) objašnjavaju da je matematička tjeskoba pod utjecajem psiholoških stanja učenika koja utječu na ishode učenja. Razina matematičke tjeskobe je značajna, posebno za učenike u početnim razredima (Cargnelutti i sur., 2017) zbog očekivanoga povećanja ishoda učenja.

Uspjeh učenja u školi odgovornost je predmetnih učitelja kao i savjetnika u školama (Bore i sur., 2013). Vođenje i savjetovanje učenika bit će učinkovito i kvalitetno ako postoji suradnja predmetnih učitelja i drugih relevantnih aktera u školi, između ostaloga, cjelokupnoga učiteljskoga i ostaloga obrazovnoga osoblja u školama (Schmidt, 2003). Stoga, potrebna je suradnja učitelja matematike i školskih savjetnika kako bi se smanjila tjeskoba učenika prilikom učenja matematike.

Suradničko grupno savjetovanje oblik je savjetodavne službe koja se realizira uključivanjem predmetnih učitelja u proces svladavanja učeničkih problema s ciljem optimiziranja njihova postignuća u učenju i razvoja u školi (Schmidt, 2003; Bore i sur. 2013; Nakimuli-Mpungu i sur., 2013). Proces suradničkoga grupnoga savjetovanja naglašava dinamičnu međuljudsku komunikaciju usredotočenu na razmišljanje i ponašanje pri zajedničkom rješavanju problema. Ono treba biti zasnovano na međusobnom povjerenju i razumijevanju predmetnih učitelja, savjetnika u školama i samih učenika (Schmidt, 2003; Jacobs, 2009, Myrick, 2011). Dakle, ova studija nastoji utvrditi razine matematičke tjeskobe i faktore utjecaja među učenicima niže srednje škole u Yogyakarti. Osim toga, kako bi se smanjila matematička tjeskoba učenika, cilj je stvoriti suradnički model učenja matematike uz grupno savjetovanje.

## Matematička tjeskoba

Hlalele (2012) definira tjeskobu općim terminom za nekoliko poremećaja koji uzrokuju nervozu, strah ili zabrinutost. Manjak samopouzdanja učenika izaziva strah od nemogućnosti bavljenja matematikom, percepciju njezine težine ili česti strah od neuspjeha. Matematička tjeskoba utječe na osjećaje i ponašanje učenika (Mutodi i Ngirande, 2014). Osim toga, Ramirez i sur. (2016) navode kako matematička tjeskoba može biti uzrokom negativnih misli pri održavanju superiorne matematičke izvedbe. S druge strane, Harari i sur. (2013) istraživali su prirodu matematičke tjeskobe na uzorku koji je uključivao 106 učenika prvog razreda. Njihovi rezultati pokazuju da se razine matematičke tjeskobe ne razlikuju prema spolu i okruženju, tj. sredini iz koje dolaze.

Matematička tjeskoba definira se kao negativna reakcija na matematiku i situacije povezane s matematičkim postignućem ili kompetencijom. Matematička tjeskoba troši resurse radnoga pamćenja i posljedično smanjuje sposobnosti rješavanja složenih

matematičkih problema (Ashcraft i Ridley, 2005). Kognitivno bolje razvijeni učenici koji doživljavaju matematičku tjeskobu izbjegavat će napredne strategije rješavanja problema, stoga učenici viših kognitivnih sposobnosti, ali s osjećajem matematičke tjeskobe imaju lošiju izvedbu od učenika nižih kognitivnih sposobnosti bez matematičke tjeskobe.

Nevid i sur. (2005) klasificiraju simptome matematičke tjeskobe u tri skupine: fizički simptomi – nervoza, drhtanje udova, znojenje, teškoće pri disanju, ubrzani rad srca, osjećaj slabosti, groznica, iritabilnost i uznemirenost; bihevioralni simptomi – izbjegavanje, drhtanje tijela, pretjerana odanost i ovisnost o drugom; kognitivni simptomi – zabrinutost, strah od nečega što se očekivano treba dogoditi u budućnosti, strah od nesposobnosti rješavanja problema, mentalna zbunjenost i teškoće u koncentraciji. Nadalje, Nevid i sur. (2005) opisali su kao ovisničko ponašanje učenika koji ovise o drugima kad god rade matematičke zadatke, tj. ne osjećaju se sposobnima sami riješiti matematičke zadatke ili problem. Učenici sa slabom autonomijom u učenju prilikom istoga doživljavaju visoku razinu tjeskobe (Kozan i sur., 2016) koja utječe na učenje i dovodi do niske samoučinkovitosti (Ahmad i sur., 2012). Osim toga, ljudi koji doživljavaju tjeskobu imaju osjećaj napetosti, krivo razumiju informacije, imaju poteškoća prilikom pamćenja i nisku motivaciju (Vitasari i sur., 2010), stoga navedene varijable postaju važne pri razumijevanju matematičke tjeskobe učenika.

Neke su razlike uočljive između fizičkih i bihevioralnih simptoma matematičke tjeskobe. Fizički simptomi nazivaju se još i somatski, a odnose se na stanje osobe i njezine fizičke, tj. tjelesne funkcije (Conley, 2006). Somatski simptomi manifestiraju se u obliku nemira, drhtanja udova, intenzivnoga znojenje, teškoća pri disanju, ubrzanog rada srca, osjećaja slabosti i zimice (Nevid i sur., 2005). Stuart (2014) te fizičke simptome naziva fizičkom napetosti, dok ih Blackburn i Davidson (1995) promatraju kao biološku napetost. Bihevioralni simptomi su reakcija pojedinca u obliku ponašanja na podražaje izvana i iznutra (Feist, 2012). Ponašanje koje se događa kao odgovor na matematičku tjeskobu uključuje izbjegavanje, drhtanje tijela i ovisnost (Nevid i sur. 2005). Važno je napomenuti kako se drhtanje udova smatra somatskim, tj. fizičkim simptomom jer se manifestira više kao fizička reakcija.

Neki faktori mogu uzrokovati osjećaj matematičke tjeskobe učenika. Guita i Tan (2018) smatraju da se matematička tjeskoba učenika može javiti zbog sljedećih uzroka: slabo vladanje osnovnim konceptima i vještinama, nerazvijene vještine rješavanja problema i kritičkoga mišljenja, razni oblici ponašanja učenika i neprimjerene vještine poučavanja i pristupi učenicima na nastavi matematike. Osim toga, matematička tjeskoba učenika povezana je s njihovim izborom tema za učenje i spolom (Oyenekan Dotun i sur., 2018). Nadalje, matematičku tjeskobu uzrokuju raznoliki faktori koji se mogu produbljivati u domu, društvu i učionici (Shields, 2005; Whyte i Anthony, 2012).

Matematička tjeskoba učenika utječe na njihov razvoj u učenju. Yamani i sur. (2018) navode da matematička tjeskoba utječe na kognitivne i afektivne procese, ima utjecaj na uspjeh učenika i štetan utjecaj na njihove buduće karijere i profesionalni razvoj.

Neke metode mogu se koristiti za smanjivanje matematičke tjeskobe učenika. Davis i Khan (2018) objašnjavaju da strategija razvoja načina učenja u autentičnoj stvarnosti svakodnevice može smanjiti matematičku tjeskobu učenika. Osim toga, kao edukatori, učitelji matematike mogu surađivati sa školskim savjetnicima s ciljem nadvladavanja učeničkih osobnih, socijalnih, akademskih problema i problema u planiranju karijere (Myrick, 2011). Suradničko učenje i grupno savjetovanje podrazumijevaju suradnju između predmetnih učitelja i školskih savjetnika koja je vrlo korisna u optimiziranju razvoja učenika.

## Metode

### Opće postavke

Ovo je istraživanje zasnovano na deskriptivnom statističkom modelu s kvantitativnim podatcima o matematičkoj tjeskobi učenika niže srednje škole u Yogyakarti. To je preliminarno istraživanje provedeno s ciljem stvaranja suradničkoga modela učenja matematike uz pomoć službe grupnoga savjetovanja i s ciljem smanjivanja matematičke tjeskobe učenika.

### Sudionici

Uzorak sudionika u ovom istraživanju obuhvatio je 2163 učenika, odabranih metodom slučajnoga uzorka, iz 44 javne i privatne škole iz pet oblasti u Yogyakarti: Bantul, Yogyakarta, Sleman, Kulonprogo i Gunungkidul. Uzorak je sačinjavalo 1122 mladića i 1041 djevojaka.

### Instrument i postupci

U ovom istraživanju korišteni su Skala matematičke tjeskobe i Upitnik čimbenika koji utječu na matematičku tjeskobu. Pouzdanost Skale matematičke tjeskobe je 0,94, a Upitnika čimbenika koji utječu na matematičku tjeskobu 0,82. Testovi pouzdanosti za ova dva instrumenta analizirani su upotrebom Cronbachove Alpha formule. Skala matematičke tjeskobe uključuje bihevioralne simptome, kognitivne simptome i nisku motivaciju kao znakove matematičke tjeskobe. Upitnik čimbenika utjecaja na matematičku tjeskobu sadrži indikatore u domu, društvu i učionici. Sakupljeni podatci analizirani su metodama deskriptivne statistike.

Skala matematičke tjeskobe koja uključuje aspekte fizičkih, bihevioralnih i kognitivnih simptoma (Nevid i sur. 2005) modificirana je dodavanjem indikatora niske motivacije za učenje matematike (Vitasari i sur. 2010; Zakariya, 2018). Ova modifikacija rezultirala je Skalom matematičke tjeskobe koja uključuje četiri aspekta: fizičke simptome, bihevioralne simptome, kognitivne simptome i nisku motivaciju. Spomenuti upitnik korišten je za ispitivanje matematičke tjeskobe 2163 učenika nižih srednjih škola u Yogyakarti.

Fizički simptomi također se nazivaju somatski simptomi i podrazumijevaju stanje osobe i njezine fizičke ili tjelesne funkcije (Conley, 2006). Fizički simptomi tjeskobe uključuju nemir, drhtanje udova, intenzivno znojenje, teškoće pri disanju, ubrzani srčani

puls, osjećaj slabosti i zimicu (Nevid i sur., 2005). Stuart (2006) te fizičke simptome naziva fizičkom napetosti, dok ih Blackburn i Davidson (1995) promatraju kao biološku napetost. Stoga, ova studija također kao fizičke simptome tjeskobe razmatra sljedeće: nemir, drhtanje udova, intenzivno znojenje, teškoće pri disanju, ubrzani srčani puls, osjećaj slabosti i zimicu.

Bihevioralni simptomi obuhvaćaju ponašanje pojedinca kao reakciju na vanjske ili unutarnje podražaje (Feist, 2012). Spomenuto ponašanje zasnovano je na stavu koji sazrijeva unutar osobe koja doživljava matematičku tjeskobu, na primjer, nedostatno samopouzdanje da se izvrši zadano ili nevoljkost da se nešto uči (Cooke i Hurst, 2012). Osim toga, oblici ponašanja kojima se manifestira matematička tjeskoba uključuju izbjegavanje, drhtanje tijela i ovisničko ili prianjajuće ponašanje (Nevid i sur., 2005). Zasnovano na spomenutim istraživanjima, i ova studija bihevioralnim simptomima smatra izbjegavanje, drhtanje tijela i ovisničko ponašanje

Kognitivni simptomi povezani su s promjenama u kognitivnom funkcioniranju osobe pri matematičkom angažmanu poput nemogućnosti jasnoga razmišljanja ili zaboravljanja onoga čega se inače možemo sjetiti (Cooke i Hurst, 2012). Osim toga, kognitivni simptomi tjeskobe također mogu uključivati sljedeće: blokade pamćenja (Vitasari i sur. 2010), percepciju težine (Zakariya, 2018), zabrinutost, osjećaj straha zbog nečega što se treba dogoditi u budućnosti, vjerovanje da će se uskoro dogoditi nešto loše, strah od nemogućnosti rješavanja problema, osjećaj zbunjenosti i teškoće pri koncentraciji (Nevid i sur., 2005). Stoga, indikatori kognitivnih simptoma u ovoj studiji su: percepcija težine matematike, emotivna uznemirenost i strah od nečega što se treba dogoditi u budućnosti, vjerovanje da će se ubrzo dogoditi nešto strašno, strah od nemogućnosti rješavanja problema, mentalna zbunjenosti ili osjećaj konfuzije (blokada pamćenja), teškoće prilikom koncentriranja i zabrinutost.

Motivacija se definira kao stanje koje pokreće osobu na poduzimanje određenih radnji kako bi se postigao cilj (Peters, 2015). Motivacija u učenju podrazumijeva učeničku voljnost, želje i entuzijazam u sudjelovanju i uspješnost tijekom procesa učenja (Moenikia i Zahed-Babelan, 2010; Yunus i Ali, 2009). S druge strane, niska motivacija jedna je od osobina učenika koji doživljavaju matematičku tjeskobu (Moenikia i Zahed-Babelan, 2010; Vitasari i sur. 2010; Zakariya, 2018), tj. visoka akademska motivacija povezana je s niskom matematičkom tjeskobom učenika (Ali i Hassan, 2019; Moenikia i Zahed-Babelan, 2010). Osim toga, Peters (2015) navodi sljedeće kao osobine ljudi s motivacijom za učenje: želja za uspjehom, entuzijazam, potreba za učenjem, nade i ideje o budućnosti, dobivanje nagrada u učenju, bavljenje zanimljivim aktivnostima i postojanje podržavajuće okoline za učenje. Stoga, ovo je istraživanje kao pokazatelje niske motivacije razmatralo sljedeće: manjak želje za uspjehom u matematici, neprepoznavanje potrebe za učenjem matematike, manjak nade u budućnost i slab interes za učenje matematike.

Dva su instrumenta korištena u ovoj studiji: Skala matematičke tjeskobe i Upitnik čimbenika koji utječu na matematičku tjeskobu. Instrumenti su razvijeni na osnovi indikatora matematičke tjeskobe koji se navode u nekoliko istraživanja:

1. Cooke i Hurst (2012) kao pokazatelje matematičke tjeskobe navode: matematičko znanje, tj. percepciju pojava i stvari, npr. iznenadna pojava misli o nedovoljnom poznavanju matematike; somatske simptome koji su povezani s individualnim tjelesnim stanjem, na primjer znojenjem ili ubrzanim otkucajima srca; kognitivne simptome koji obuhvaćaju promjene u razmišljanju pri bavljenju matematikom poput nemogućnosti jasnoga razmišljanja ili zaboravljanja stvari kojih se inače možemo sjetiti; simptome vezane uz stavove koji se javljaju kada osoba ima matematičku tjeskobu, na primjer nedovoljno samopouzdanje ili nevoljnost da se učini zadano.

2. Nevid i sur. (2005) klasificiraju simptome tjeskobe u tri tipa: fizičke, bihevioralne i kognitivne simptome.

3. Das i Das (2013) kategoriziraju simptome matematičke tjeskobe u tri skupine: fizičke, psihološke i bihevioralne simptome.

4. Vitasari i sur. (2010) spominju sljedeće kao osobine ljudi koji doživljavaju matematičku tjeskobu: osjećaj napetosti, krivo razumijevanje informacija, blokade pamćenja i niska motivacija.

5. Zakariya (2018) objašnjava kako osobine matematičke tjeskobe uključuju tjeskobu pri učenju matematike, percepciju težine i motivaciju.

6. Niska motivacija postaje jedna od osobina učenika koji doživljavaju matematičku tjeskobu (Moenikia i Zahed-Babelan, 2010; Vitasari i sur., 2010; Zakariya, 2018).

7. Visoka akademska motivacija povezana je s niskom matematičkom tjeskobom učenika (Ali i Hassan, 2019; Moenikia i Zahed-Babelan, 2010).

Zasnovano na indikatorima matematičke tjeskobe iz navedenih istraživanja, ova studija koristi Skalu matematičke tjeskobe čiji je dizajn zasnovan na fizičkim, kognitivnim i bihevioralnim simptomima te niskoj motivaciji.

Osim toga, drugi instrument je Upitnik faktora koji utječu na matematičku tjeskobu, a koji je razvijen na osnovi sljedećih istraživanja:

1. Whyte i Anthony (2012) objašnjavaju da faktori koji doprinose matematičkoj tjeskobi učenika mogu proizlaziti iz doma, društva i razreda.

2. Uključenost roditelja i prijatelja u tehnike učenja mogu biti faktor utjecaja na učeničko sudjelovanje u učenju matematike (Wahid i sur., 2014).

3. Matematička tjeskoba može biti uzrokovana faktorima okoline poput negativnih iskustava s roditeljima i učiteljima (Aarnos i Perkkilä, 2012).

4. Trujillo i Hadfield (1999) objasnili su kako faktori utjecaja na matematičku tjeskobu učenika uključuju čimbenike osobnosti (psihološke i emocionalne), okolišne ili socijalne čimbenike i intelektualne čimbenike.

Na osnovi rezultata istraživanja tih stručnjaka, ova studija usredotočila se na okolišne i vanjske faktore koji utječu na matematičku tjeskobu učenika. Stoga kao osnova za mjerenje faktora utjecaja na matematičku tjeskobu služe dom, društvo i razred. Oni se, dakako, mogu razmatrati pri utvrđivanju vrste tretmana za smanjivanje matematičke tjeskobe učenika putem poboljšanja uvjeta okoline.

Aspekti i indikatori Skale matematičke tjeskobe i uzročni faktori matematičke tjeskobe korišteni u ovom istraživanju prikazani su u Tablici 1. Ovaj instrument sastoji se od 92 pitanja na koja su sudionici odgovarali s ciljem utvrđivanja razine matematičke tjeskobe i čimbenika koji ju uzrokuju.

Tablica 1.

## Rezultati

Opisali smo matematičku tjeskobu koju doživljavaju učenici u Yogyakarti na osnovi rezultata skale primijenjene na uzorku od 2163 učenika iz 44 niže srednje škole. Uzorak je uključivao 1122 dječaka i 1041 djevojke u dobi od 13 do14 godina. Rezultati analize podataka kategorizirani su u pet kategorija, prema intenzitetu tjeskobe učenika: vrlo visoka, visoka, srednja, niska i vrlo niska. Gotovo 43,78 % učenika pripada u srednju kategoriju, 7,44 % u visoku kategoriju i 0,60 % u vrlo visoku. Ovi podatci pokazuju da većina učenika u nižim srednjim školama u Yogaykarti doživljava matematičku tjeskobu i zahtijevaju preventivna nastojanja različitih aktera kako bi savladala taj problem. Kategorizacija učenika prema razinama matematičke tjeskobe prikazana je u Tablici 2.

Tablica 2.

Rezultati analize podataka pokazuju da se matematička tjeskoba mnogih učenika u nižim srednjim školama u Yogyakarti manifestira, između ostaloga, u obliku kognitivnih simptoma, s prosječnom vrijednosti od 2,33 čestice. Kognitivni simptomi uključuju zabrinutost, strah od nečega što se očekivano treba dogoditi u budućnosti, uvjerenje da će se uskoro dogoditi nešto zastrašujuće, strah od nesposobnosti rješavanja problema, mentalna zbunjenost i teškoće s koncentracijom (Nevid i sur., 2005). Osim toga, aspekti matematičke tjeskobe učenika obuhvaćaju i fizičke simptome, s prosječnom vrijednosti od 2,24 čestice. Ovi aspekti matematičke tjeskobe učenika prikazani su na Slici 1.

Slika 1.

U ovom istraživanju također je ustanovljeno da je matematička anksioznost dječaka veća od one koju doživljavaju djevojčice. Srednja vrijednost matematičke tjeskobe dječaka je 130,68, a djevojčica 121,30. Osim toga, analiza podataka pokazala je najvišu prosječnu razinu matematičke tjeskobe oboje dječaka (2,40) i djevojčica (2,26) u aspektu kognitivnih simptoma. Usporedba prosječnih vrijednosti aspekata matematičke tjeskobe dječaka i djevojčica prikazana je na Slici 2.

Slika 2.

Kako bismo utvrdili čimbenike utjecaja na matematičku tjeskobu 2163 učenika nižih srednjih škola iz Yogyakarte, koristili smo Upitnik o čimbenicama matematičke tjeskobe, tj. domu, društvu i učionici (Whyte i Anthony, 2012). Ovi čimbenici opisani su pomoću analize rezultata skale koja je primijenjena na uzorku od 2163 učenika 44 niže srednje škole: 1122 dječaka i 1041 djevojčice.

Rezultati analize podataka pokazali su kako faktor doma ima najveći utjecaj na matematičku tjeskobu učenika, sa srednjom vrijednosti 2,14. Faktor doma uključuje utjecaj roditelja i braće i sestara (Whyte i Anthony, 2012). Sljedeći čimbenik utjecaja na tjeskobu učenika je učionica, s prosječnom vrijednosti 2,13, a treći je društvo, s prosječnom vrijednosti 2,02. Prosječne vrijednosti faktora utjecaja na matematičku tjeskobu prikazani su u Tablici 3.

Tablica 3.

Utvrđene su razlike u čimbenicima utjecaja na matematičku tjeskobu dječaka i djevojčica. Najutjecajniji faktor matematičke tjeskobe dječaka je dom, s prosječnom vrijednosti 2,24, dok je za djevojčice najutjecajniji faktor učionica. Usporedba čimbenika koji utječu na matematičku tjeskobu dječaka i djevojčica prikazana je na Slici 3.

Slika 3.

## Rasprava i zaključci

Rezultati ovoga istraživanja pokazuju da se najviša razina matematičke tjeskobe manifestira u kognitivnom aspektu: kada su bili suočeni s nastavnom matematike ili problemima, učenici su bili zabrinuti ili se bojali budućnosti. Taj je strah posljedično slabio njihovu mentalnu sposobnost, narušavajući njihov fokus i slabeći koncentraciju. U skladu s istraživanjem koje su proveli Núñez-Peña i Suárez-Pellicioni (2014), neki učenici bili su opterećeni ometajućim mislima koje su bile rezultat tjeskobe. U drugim referencama navodi se da matematička tjeskoba stvara blokade pamćenja, što nekim učenicima otežava pamćenje sadržaja. (Young i sur., 2012).

Ova je studija također pokazala da je matematička tjeskoba dječaka viša nego među djevojčicama. Taj rezultat suprotan je rezultatima istraživanja Devine i sur. (2012) koji su ustanovili da učenice u Engleskoj doživljavaju višu matematičku tjeskobu nego učenici. Osim toga, nalazi ove studije također se razlikuju od rezultata istraživanja Birgin i sur. (2010) koji ukazuju na negativnu korelaciju između matematičke tjeskobe i učeničkoga interesa za znanstvene karijere, bez obzira na njihove razine matematičke vještine i spol.

U ovom istraživanju također je ustanovljeno da je najznačajniji faktor utjecaja na matematičku tjeskobu učenika iz Yogyakarte dom, tj. utjecaj roditelja te braće i sestara. Ovaj rezultat u skladu je s istraživanjem koje su proveli Soni i Kumari (2017) s učenicima petih do desetih razreda, a koje je ustanovilo jaku korelaciju između matematičke tjeskobe roditelja i one njihove djece. Osim toga, socijalne interakcije između roditelja i matematička tjeskoba učenika su u pozitivnom odnosu; ipak, taj odnos ne možemo objasniti samo genetikom (Maloney i sur., 2015). Roditelji koji vjeruju da je matematika beskorisna i imaju nisku matematičku samoučinkovitost i slabu motivaciju za uspjeh u matematici mogu smanjiti motivaciju vlastite djece za učenje, stoga i njihove rezultate u učenju matematike, što vodi većoj zabrinutosti te djece zbog matematike (Maloney i sur., 2015). Naposljetku, ovim je istraživanjem ustanovljeno kako je učionica čimbenik

s najvećim utjecajem na matematičku tjeskobu djevojčica. Kompetitivno razredno okruženje može stvoriti tjeskobu povezanu s matematikom (Gunderson i sur., 2012).

Rezultati ovoga istraživanja mogu se upotrijebiti kao osnova za dalja istraživanja s ciljem pronalaska učinkovitih strategija smanjivanja matematičke tjeskobe. Učitelji matematike trebaju surađivati sa savjetnicima u školi kako bi razvili učeničko samopouzdanje u matematici i smanjili njihovu matematičku tjeskobu (Furner, 2017). Suradnja između učitelja matematike i savjetnika može se ostvariti u obliku suradničkih aktivnosti (Myrick, 2011). Nadalje, navodi se da je suradnja između relevantnih aktera u obrazovnom programu i učeničkoga razvoja jedna od osobina učinkovite škole. Naposljetku, Dahir i Stone (2012) predložili su da se suradnja s uključenim stranama odvija unutar i izvan škole.

U školskom kontekstu savjetnici mogu raditi zajedno s administratorima, drugim učiteljima i učenicima. Jedna od mogućnosti je primjena timskoga rada s administrativnim osobljem kako bi se osnažila uprava škole. Suradnja s drugim učiteljima može biti u obliku upravljanja razredom, stvaranja ugodnih uvjeta za učenike, konzultacija, studija slučaja, dijeljenja priča o uspjehu, promocije programa i tretmana za učenike koji zahtijevaju posebnu pažnju, poput remedijalne. Konačno, savjetnici mogu surađivati s učenicima organizirajući suradnju među vršnjacima.

Kako bi savjetovanje bilo učinkovito u smanjivanju matematičke tjeskobe učenika, potrebno ga je provoditi u skupinama s malim brojem članova (Furner, 2017; Ruff i Boes, 2014). Grupno savjetovanje je bolje od individualnoga jer članovi grupe trebaju informacije od ostalih članova, uče slušati i poštivati druge, a ne samo govoriti. U okolini adolescenta grupno savjetovanje je bolje od individualnoga jer adolescenti obično više vole razgovarati s drugim tinejdžerima nego s odraslima (Corey, 2012; Jacobs, 2009).

Tijekom osiguravanja usluga suradničkoga učenja i grupnoga savjetovanja u smanjivanju matematičke tjeskobe učenika, potrebno je paziti na kulturološki kontekst. U pružanju savjetodavnih usluga, nužno je razmotriti kulturu (Corey, 2012). Učenje u razredu koji pohađaju učenici iz različitih zemalja može utjecati na matematičku tjeskobu učenika (Hamza i Helal, 2013). Razredna kultura postaje standard ponašanja i normi koje utječu na stil razrednih interakcija. Proces učenja matematike strogo je strukturiran i u njemu ne postoji izobilje prilika za raspravu. Usredotočenost na pronalaženje točnih odgovora i nada u nalaženje brzih rješenja mogu doprinijeti matematičkoj tjeskobi učenika (Shields, 2005; Whyte i Anthony, 2012).

Kultura ima utjecaj na matematičku tjeskobu koju doživljavaju učenici (Luttenberger i sur., 2018). Azijski učenici skloni su postavljati visoke ciljeve i ocjenjivati sami sebe prema strogim standardima (Ashcraft i Moore, 2009). Osim toga, učenici i roditelji Azijci manje su zadovoljni izvedbom od učenika i roditelja koji nisu iz Azije (Lee, 2009). Nadalje, kultura je jedan od čimbenika koji utječe na pojavu matematičke tjeskobe, uz karakteristike obrazovnoga sustava. Stavovi roditelja i učitelja, kao i osobine samih učenika, također utječu na matematičku tjeskobu (Casad i sur., 2015; Luttenberger

i sur., 2018). Stoga treba naglasiti i kulturološke faktore kao utjecaj na matematičku tjeskobu učenika.

Razumijevanje uvjeta u kojima žive učenici i njihovih kulturalnih vrijednosti postaje čimbenik u procesima učenja i savjetovanja (Corey, 2012; Gerstein i sur., 2011; Huang, 2010). Kulturološka vrijednost lokalne mudrosti može se upotrijebiti kao osnova za učenje i savjetovanje učenika iz multikulturalnih sredina (Darojah i sur., 2018; Subali i sur., 2015). U učenju matematike mnogo je stvari usko povezano s lokalnom mudrošću u Indoneziji poput uvjeta, situacija, kulture i građevina kulturne baštine u regijama Indonezije koje se smatraju vrijednostima lokalne mudrosti (Setiawan i sur., 2017). Osim toga, proces savjetovanja koji se zasniva na kulturološkim vrijednostima i regionalnoj umjetnosti može poslužiti kao osnova za suradnički model dizajniran kako bi se savladali razni problemi učenika. (Habsy, 2017). Dakle, suradnička strategija učenja i grupno savjetovanje s ciljem smanjivanja matematičke tjeskobe mogu se zasnivati na vrijednostima lokalne mudrosti. Bilo bi zanimljivo kada bi se neka od budućih istraživanja usmjerila na određivanje doprinosa lokalne mudrosti Yogyakarte smanjivanju matematičke tjeskobe. Istraživači koji su proveli ovo istraživanje uvjereni su da obitelji i zajednica također mogu pridonijeti smanjivanju tjeskobe učenika.

Matematička tjeskoba učenika nižih srednjih škola u Yogyakarti većinom se manifestira kognitivnim simptomima. Svih 2163 učenika doživjelo je matematičku tjeskobu različitoga intenziteta: vrlo visoku, visoku, srednju, nisku ili vrlo nisku. Najznačajniji faktor utjecaja na matematičku tjeskobu je dom, tj. interakcije s roditeljima te braćom i sestrama, a drugi čimbenik je razred. Nadalje, suradnja između raznih uključenih strana u školi je potrebna kako bi se smanjila matematička tjeskoba učenika. Suradnja između predmetnih učitelja, savjetnika u školi i roditelja u smanjivanju matematičke tjeskobe učenika je esencijalna za optimiziranje njihova razvoja i postignuća u matematici. Stoga se rezultati ovoga istraživanja mogu upotrijebiti kao osnova za osmišljavanje suradničkoga modela učenja matematike putem grupnoga savjetovanja s ciljem smanjivanja matematičke tjeskobe učenika.