Mathematics anxiety of senior high school students based on extrovert and introvert personality types

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Abstract. Mathematics is viewed by some students as a difficult subject, resulting them to be anxious when they are dealing with mathematics learning. Therefore, what and how mathematics anxiety have become an interesting issue to be studied. This study aims to describe mathematics anxiety profiles of senior high school students based on types of personality, which are extrovert and introvert. The study used qualitative method with triangulation strategy for collecting data in the forms of questionnaire regards extrovert and introvert personality types, MAS (Mathematics Anxiety Scale) questionnaire and interview. The subject of research were students from the 11th grade of one of high schools in Bandung. The result showed that: (1) extrovert students assume that mathematics is difficult so that they feel worried and are lack of enthusiasm when they are in the classroom, which the highest anxiety is when they are dealing with examination and assignment provided by their teacher, resulted that they feel scared, nervous, dizzy, and get stomach-ache; (2) introvert students assume mathematics as a complicated but interesting subject in the sense of they feel worried in classroom but they are calm and ease in facing examination but when they are appointed by teacher, they feel scared and not confidence.

1. Introduction
Teenager is an age where a person experiences psychological changes and personality formation so that they are vulnerable to high levels of anxiety. Anxiety often occurs among students when facing examinations or learning activities that make them feel unhappy because having to answer questions so that there is a feeling of discomfort or tense. In fact, sometimes students assume exams or learning activities as a problem, because they worry to be embarrassed or will get bad grades. Fear or tension in dealing with problems is called anxiety.

Anxiety in mathematics cannot be seen as an ordinary matter, students' inability adapt to learning potentially causes difficulties and phobias towards mathematics which ultimately lead to low learning outcomes and student achievement in mathematics [1]. Anxiety in mathematics can occur in both elementary and high school students, and even can be a determinant of their views on mathematics in the future. Moreover, the abstract of mathematics material can make students do not like mathematics, then causing anxiety. Furthermore, negative effects of mathematical anxiety are defined as feelings of
panic, hopelessness, paralysis, mental disorganization that arises in students when they are required to solve mathematical problems [2].

There are a number of factors associated with mathematical anxiety, ranging from environmental factors, such as family pressure to get higher achievement, to intellectual factors as learning styles or personality factors, such as inferiority [3]. Lack of confidence when working in mathematical situations is also considered because mathematical anxiety [4].

Personality is one of the factors of mathematical anxiety that interpreted as a whole pattern of attitudes, feelings and expressions as well as habits in dealing with situations [5]. Personality types are grouped into two major groups, namely extroverted personality types and introverted personality types [6]. Extrovert characters tend to be gregarious, whereas introverts tend to be personal, and extroverts’ activities are directed to the outside world extroverted activity is directed to the outside world or directed to others, while introverted feelings are inward to themselves [7]. Generally, extroverts are sociable, like parties, have lots of friends, love excitement, act when there are moments, and spontaneous. On the contrary, introverts’ characteristics tend to be silent, introspective, self-interested and reflective, they do not believe in impulsive decisions and prefer a calm and orderly life rather than a life filled with opportunities and risks [8].

Personality, however, has an influence on students' mathematical anxiety. This is possible from different extrovert and introvert personality traits, such as calmness, attitude making decisions in acting, and so forth. Individuals who are classified as introverts will be more oriented to internal stimuli than individuals who are extroverts. Introverts will pay more attention to thoughts, moods and reactions that occur within themselves [9], while individuals who are classified as extroverts are much influenced by external stimuli, their thoughts, feelings and actions are largely determined by their environment [10]. The difference between extroverted and introverted personality types, in some way, will distinguish the level of mathematical anxiety, especially when students face math test. As such, personality which is a form of a person's habits or behavior will influence how the person behaves.

Based on the background, the researcher wanted to know how mathematical anxiety in high school students, based on extroverted and introverted personality types, as knowledge and insight that could be used as a reference frame and development of mathematical research. Furthermore, the results of the research obtained can be used to maximize the learning process by creating a pleasant learning environment that does not cause tension.

1.1 Mathematics anxiety

The word anxiety comes from Latin ‘angustus’ which means rigid and ‘angio/anci’ which means suffocating. Feeling of discomfort, fear and tension in the face of such problem are called anxiety. Anxiety is an unpleasant condition which includes worry, confusion, dislike which is subjective and arises because of a perceived feeling of insecurity against danger will occur [11]. While Crow and Crow [12] suggested that anxiety is something unpleasant conditions experienced by individuals that can affect their physical condition. Another opinion stated that anxiety is a manifestation of symptoms or physiological disorders such as trembling, lots of sweat, nausea, headache, frequent urination, palpitations [13].

Mathematical anxiety is a form of one's feelings, both in the form of fear and tension in dealing with mathematical problems or in carrying out mathematics learning with various forms of symptoms caused. People who have mathematical anxiety tend to think of mathematics as something unpleasant [12]. Ashcraft and Faust offer an understanding that mathematical anxiety is feeling depressed and even fear mixed with extraordinary errors in numbers and solving math problems [14]. Another statement suggested that mathematical anxiety is an emotional response to mathematics when someone attends math classes, solving mathematical problems and discussing them [15].
Based on the description above, it can be concluded that mathematical anxiety is a form of emotional response and feelings, such as feeling depressed, tense and fear mixed with extraordinary errors in understanding numbers, solving mathematical problems or doing mathematics learning.

Anxiety in mathematics cannot be seen as just a matter. Students' inability to adapt learning causes students difficulties and phobias of mathematics which ultimately lead to low learning outcomes and student achievement in mathematics [1]. Symptoms of anxiety which are often experienced by a person can be seen as physical symptoms such as excessive sweating even if the air is not hot and not because of exercise, the heart beats extra fast, feeling cold on the hands or feet, experiencing indigestion, feeling dry mouth, feeling dry throat, looking pale, frequent urination beyond the limits of reasonableness, and etc. [12].

1.2 extrovert and introvert personality types
Each individual unwittingly has different ways of behaving, talking and thinking. Those all can happen because each individual has a different type of personality. Personality is the overall pattern of attitudes, feelings and expressions as well as one's habits in dealing with situations [5]. Habits that exist in a person will affect how someone behaves and acts in making a decision.

Personality is a characteristic of a person that causes the emergence of feelings, thoughts and behaviors, which is unique and consistent so that it can be used to distinguish individuals [9]. Another opinion states that personality is a characteristic or style of a person that comes from the form received from the environment, for example, family in childhood or innate someone from birth [16].

From several opinions, it can be concluded that personality is a characteristic of a person in the form of feelings, behaviors, thoughts and habits which are consistent so that they can distinguish individuals from one (to) another and depending on the formations received from the surrounding environment.

Regarding the type of personality, Carl Gustav Jung, a psychiatrist from Swiss, stated that individual personality can be distinguished between personalities, namely introvert and extrovert [6]. The classification of introverted-extroverted personality types is based on differences in responses, habits and traits displayed by individuals in carrying out interpersonal relationships, besides that personality types also explain the position of individual tendencies associated with reactions or behavior [17].

Extrovert characters tend to be gregarious, while introverts tend to be personal, extroverted activities are seen directed to the outside world and introverted feelings inward to themselves. Introverts tend to be more careful but less fast than extroverts [7,8].

Eysenck groups two types of extroverted and introverted personalities by giving characteristics to all human activities as follows:

a. The typical thing of someone who has an extroverted personality type is having a social nature, likes parties, has lots of friends, needs friends to talk to, doesn't like to study alone, likes excitement, takes chances, tends to take risks, often acts according to situations, and is impulsive. In addition, they like to joke, always have answers that are ready, like change, want to be free, easy going, optimistic, always happy, always moving, tend to be aggressive, and easily angry, their feelings are not related to control, and cannot be the person reliable.

b. The characteristic of someone who has an introverted personality type is quiet, calm, introspective, prefers to read books rather than relate to other people, withdraw, take distance except close friends, plan ahead, do not follow impulses that arise in certain situations, does not like excitement, is serious, likes a regular life, maintains feelings, is not easily angry, rarely aggressively, is reliable, pessimistic, and gets its core value on ethical standards [18].

In addition, Jung described extroverted and introverted personality types as follows:

a. Extroverted personality types generally have the characteristics of being mindful or outgoing, free and socially open. Have an interest in diversity, swiftness, and impatience in facing sluggish work, and working in groups. An extroverted person has a tendency to direct attention out of him, so that all
interests, attitudes, and decisions taken are more determined by events that occur outside of him. Basically someone who is extroverted shows a more open attitude and is willing to accept input from outside, active, gregarious, and suave. Generally they are easy to adapt to the environment and culture of the people around them, and try to make appropriate decisions and harmonize with the demands and expectations of the environment.

b. Introverted personality types generally has traits that tend to withdraw, like to work alone, be calm, shy, but diligent, careful in making decisions, and tend to be socially closed. An introverted person has a tendency to draw from his social environment, so that his interests, attitudes, and decisions are always based on his own feelings, thoughts, and experiences. Basically someone who is introverted tends to be quiet, and does not need other people because he feels that all of his needs can be fulfilled by himself [6].

While the properties of the introvert type are a) fluent writing rather than speaking; b) tend/often overcome concerns; c) shy and whiny; d) tend to be radical; e) like to read books and magazines; f) more influenced by subjective feelings (within him); g) closed; h) liking self-employed; i) very cautious of himself; j) difficult to adapt in association [10].

Of some of the above opinions, an extrovert personality is someone who has distinctive traits or things like acting spontaneously, active (likes to move for activity), socially open, impatient, adaptable. In the association, likes to work in groups. While an introvert personality is someone who has distinctive traits or things like being cautious in acting, liking a well-organized lifestyle, socially enclosed, calm, adaptive in association, tends to quiet and likes to work alone.

2. Methods
This research is a descriptive qualitative research that aims to describe the mathematical anxiety profile of high school students based on extroverted and introverted personality types. The subjects taken in this study used purposive sampling technique. This technique is a data retrieval technique that uses consideration of extroverted-introverted personality types and mathematical anxiety possessed by students. The subjects in this study consisted of four 11th grade high school students, two students with extrovert personality and two introvert students, who were selected based on the results of a questionnaire of personality types.

The instruments used in this study were extroverted and introverted personality type questionnaires adapted from the questionnaire used by Lestari [19] to obtain data on extroverted and introverted student groups, MAS (Mathematics Anxiety Scale) questionnaire adapted from questionnaires used by Mahmood and Khatoon [20] to obtain mathematical anxiety data. In addition there are also interview guidelines that are used to convince researchers of data obtained from the MAS (Mathematics Anxiety Scale) questionnaire.

In filling out the questionnaire sheet, students are asked to answer by giving a checklist to the choices with extroverted and introverted personality type questions by choosing "Yes" or "No" answers. Whereas in the MAS questionnaire, the choices used Likert scale with options strongly disagree (STS), disagree (TS), undecided (N), agree (S), and strongly agree (SS).

The selection of the research subjects was based on the tendencies of the student's answer analysis as indicated on the extrovert-introvert personality type questionnaire and MAS (Mathematics Anxiety Scale) questionnaire. The data analysis of the questionnaire used scoring guidelines. Based on the analysis of the results of MAS (Mathematics Anxiety Scale) questionnaire and interview, the researcher described the level of mathematics anxiety of high school students referred to extroverted and introverted personality types.

3. Result and Discussion
3.1. Mathematics anxiety of senior high school students based on extrovert personality type

According to the extrovert students, the first thing when they heard the word mathematics, they assumed that mathematics is something difficult and made them tensed. Before entering mathematics class, extrovert students sometimes felt worry and lack enthusiasm. This happens when the teacher was not friendly with them. When they faced math exams, the extrovert students felt tensed, anxious and afraid that would happen because they felt less in preparation before the exam.

Extrovert students felt lack of confidence, nervous, dizzy, even stomach-ache when they were appointed by the teacher to answer the questions or comment the material, because they worried to take wrong answers. They usually asked their friends when they could not answer the questions. Extrovert students dared to ask the teacher when there was something has not understood yet, even though they recognized that mathematics is something less interesting, and they assumed that mathematics is not their favourite subject. When they were solving math problems they sometimes felt dizzy. If they were given homework, then the extrovert students would do everything they could. However, sometimes they were less eager to know the content of the homework.

3.2. Mathematics anxiety of senior high school students based on introvert personality type

According to the introvert student, the first thing when they heard the word math, they would think that mathematics is something complicated but interesting. They had a high curiosity to learn mathematics, especially when they are working on math problems and they would feel happy when they are able to finish it. Before entering math class, introvert students sometimes felt worry not being able to do learning activities. When they faced math exams, introvert students felt calm because they have prepared anything to anticipate their anxiety because they were afraid that they would not able to do it.

When the teacher asked anything related to the material, introvert students usually answered it immediately even though there were feelings of fear, heart palpitations and lack of confidence because they worried that the answers they made were wrong. If they found difficulties, introvert students would usually looked at the textbook to understand it. Introvert students dared to ask the teacher if there was material that had not been understood. They had an interest in learning mathematics and assumed that mathematics was one of their favorite subjects and hoped that mathematics can be a support for their values. When solving math problems, introvert students sometimes felt dizzy because they had difficulties to find the answers. If they were given homework, then introvert students would try to do it and discuss with their friends when they found difficulties.

4. Conclusion

Based on the results of the discussion that has been described regarding the mathematical anxiety of high school students, which are extroverted and introverted personality types, we can conclude that: a) Extrovert students assume that mathematics is a difficult thing. Feeling worry and lacking in enthusiasm while in math class, feeling very anxious when facing a math exam and when they are appointed to work on math problems, even feeling afraid, nervous and dizzy when they are faced with it. In addition, extrovert students feel less interested and assume that mathematics is not their favorite subject; b) Introvert students assume that mathematics is something complicated but it is interesting. Sometimes they feel worry when they attend math class, but feeling calm and easy when they are faced with a math test, the highest anxiety will happen when they are asked to work on math problems, even they feel scared and lack confidence. Introvert students feel interested and assume that mathematics is one of their favorite subjects, and hope mathematics can support their values.

One of the factors causing mathematics anxiety of extrovert and introvert students is the appearance of the teacher when teaching mathematics. It will cause tension which ultimately makes them feel nervous, even afraid, when facing math lessons. For that, some experts recommend learning techniques that can be applied to students with high levels of anxiety is creating an atmosphere of learning that will
not make students feel threatened by having to answer oral questions and humiliated in front of the class [5].

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Appendixes 1: Questionnaire of extrovert and introvert personality types

| Questions                                                                 | Responses |
|--------------------------------------------------------------------------|-----------|
| Do you frequently face exciting moments?                                 | Yes       |
| Are you a person who doesn’t care with many things?                      | No        |
| Will you think things before doing anything?                             | Yes       |
| Do you generally do and say things quickly without stopping to think?   | Yes       |
| Do you like to do anything challenging?                                  | No        |
| Do you frequently do something spontaneously?                            | Yes       |
| Do you prefer to do reading or to meet people?                           | No        |
| Do you like travelling?                                                  | Yes       |
| Do you prefer to have few but special friends?                           | Yes       |
| When people shout at you do you shout back?                             | No        |
| Can you usually let yourself go and enjoy yourself a lot at a lively party? | Yes       |
| Do other people think of you as a person who is full of enthusiasm?      | No        |
| Are you mostly quiet when you are with other people?                    | Yes       |
| If there is something you want to know about, would you rather look it up in a book than talk to someone about it? | No |
| Do you like a job that suits your expertise?                             | Yes       |
| Do you hate being with a crowd who play jokes on one another?            | No        |
| Do you like doing things in which you have to act quickly?              | Yes       |
| Are you often in a hurry to do something?                                | No        |
| Do you really like talking to other people even to new people?           | Yes       |
| Do you feel upset if you don't see many people most of your time?       | No        |
| Do you think that you are a confident person?                            | Yes       |
| Are you comfortable at a lively party?                                  | No        |
| Can you easily liven up the party atmosphere or boring activities?      | Yes       |
| Do you sometimes talk about something you don't know about?             | No        |

Appendixes 2: Questionnaire of MAS (Mathematics Anxiety Scale)

| Questions                                                                 | Responses |
|--------------------------------------------------------------------------|-----------|
| Mathematics is most dreaded subject for me                               | STS       |
| Mathematics makes me feel comfortable and easy                           | TS        |
| I feel worried before entering the math class                            | N         |
| I think math interesting                                                | S         |
| Mathematics is one of my favorite subjects                               | SS        |
| I am always afraid of mathematics examinations                           | STS       |
| Solving mathematics problems is always pleasant for me                  | TS        |
| I feel nervous when I am about to do mathematics homework                | N         |
| I feel happy and excited in a mathematics class as compared to any other class. | S |
| I would prefer math as one of my subjects in higher studies             | SS        |
Mathematics makes me a headache.
Mathematics doesn’t scare me at all
My mind goes blank when teacher asks math questions

Note: STS: Strongly disagree; TS: Disagree; N: Undecided; S: Agree; SS: Strongly Agree