Journal of Positive School Psychology http://journalppw.com
2022, Vol. 6, No. 6, 1676-1685

Construction And Validation Of Attitude Towards Mathematics Scale (Atms)

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Abstract

This article reports constructing and validating a scale to measure the students' Attitude Towards Mathematics suited for the Indian population. Items for the scale were generated based on existing tools, literature reviews, and discussions with experts, teachers and students. After item generation, content validity and inter-item reliability were established. A random sample of 518 (245 males and 273 females) students studying in classes 8, 9 and 10 were selected from three schools. Most of the students were between 13 to 16 years of age. Factor analysis with a varimax rotation generated three factors: negative attitude towards mathematics, tendency to avoid mathematics and positive attitude towards mathematics. The psychometric properties were comprehensive; thus, the present scale can be recommended for investigating high school students' attitudes towards mathematics.

Keywords: Attitude, Attitude towards mathematics, Factor analysis.

1. Introduction

Attitudes are simply expressions of how much we like or dislike various things. (Chaiklin, 2011) has found that 'attitude' is one of the social science concepts studied very frequently by social scientists. Psychologists define attitude as a learned tendency to prefer or evaluate things, objects, events, issues and people (often positive or negative) in a certain way. Attitude is a liking - disliking, pro - anti, favouring - not favouring, and positive - negative (Morgan et al. 2010).

Allport (1935) gave the earliest definition of attitude. He defined attitude as a "mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations related to it." Aiken (1970) defined attitude as "a learned predisposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept, or another person." Anastasi defined attitude as "a tendency to react favourably or unfavourably towards a designated class of stimuli, such as a national or racial group, a custom, or an institution. It is a dispositional readiness to respond to specific situations, persons, or objects." Despite many definitions of attitude, the researchers do not have a standard and universally accepted definition of attitude. An attitude can have affective, behavioural and cognitive dimensions that psychology calls the ABC model (Ajzen, 1993). Researchers and psychologists also suggest these three components of attitude (Syyeda, 2016). The above definitions clearly explain that the formation of attitude is experiential. According to social psychology, people form attitudes through their experiences in life using three learning theories: classical conditioning (learning through association), Operant conditioning (giving feedback on the performance of a learner), and Observational learning (learning by watching others).

Mathematics is one of the most challenging subjects in education. Mathematics has become an essential skill of human beings. Every human being, daily in some form or

another, uses the application of mathematics. Students' attitudes towards mathematics subject could be either positive or negative. Negative mathematical experiences affect students' attitudes toward their achievement and performance. The students themselves determine the negative experiences: looking very stupid in front of the class, being in a class where other students are above one's competency level, and regular absenteeism due to lack of preparedness could easily make the students dislike mathematics. If a student's attitude is negative, it could be due to a) environmental factors (negative experiences in the class- someone may do poorly in maths because of lack of skill, teacher characteristics, parental gender stereotypes and b) personal factors (learning styles, low self-esteem and gender contributes to higher levels of maths anxiety and Attitude towards maths – those who generally like will have less anxiety than those who don't like maths) and c) on Intellectual factors (Mathematics learning disability and Dyscalculia). Kundu and Kar (2018) believed that attitude plays a vital role in mathematics achievement, and a positive attitude generates optimism and improves the willingness to learn.

On the contrary, a negative attitude enhances mathematics anxiety (Trujillo & Hadfield, 1999), contributing to resistance, learning and poor performance in mathematics. Kiss and Vukovic (2017) mentioned that up to 93 % of the students report at least some negative experience with mathematics from kindergarten through college.

Definition of Attitude towards Mathematics

Even though eminent researchers like Allport, Neale, Aiken, Martin and Zan and Hannula have attempted to define and redefine mathematics attitudes in education, no common definition has arrived to be accepted by all the scholars. The following is the operational definition of the investigator for this study as proposed by Neale (1969). He defined attitude toward mathematics as an aggregated measure of "liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless." The investigator developed the measuring tool on the Attitude Towards Mathematics Scale (ATMS) based on the definition of Neale (1969) on Mathematics attitude as mentioned above.

Tools on Attitude Towards Mathematics

Researchers developed many psychological instruments to measure mathematics attitude based on various definitions of attitude in the past. The attitude towards mathematics was first measured by observing actual and intended behaviour (Dwyer & Evelyn, 1993), but it was inaccurate. Later, researchers prepared and used self-report questionnaires to measure the mathematics attitude based on various scales like the Thurstone scale, the Likert scale, the Guttman scale, and the Semantic differential scale. But, today, researchers and scholars mostly use the Likert Scale to measure attitude.

Need for the tool construction

Attitude towards mathematics is closely related to the achievement of success in mathematics. Researches show a positive correlation between mathematics attitude and mathematics achievement. In contrast, a significant negative correlation exists between mathematics anxiety and mathematics achievement. Mathematics educators strongly believe that students with a negative attitude will have mathematics performance problems due to anxiety. Students would achieve success if they had a positive attitude toward mathematics. In the past, researchers attempted to develop many uni-dimensional and multi-dimensional attitude scales to measure the attitude toward mathematics. In 1954, Dutton Scale measured 'feelings' towards arithmetic. Later, Aiken and Dreger constructed an attitude scale with two dimensions: the enjoyment and value of mathematics. In 1972, Richardson and Suinn developed a mathematics anxiety Rating scale to measure only mathematics anxiety. Later, in 1982, Plake and Parker revised the Mathematics Anxiety Rating Scale (MARS-R). Finally, Mathematics Attitude Scales, developed by Fennema-Sherman in 1976, became the most popular scale among researchers. It consisted of nine instruments: 1. Attitude Toward Success in Mathematics Scale, 2. Mathematics as a Male Domain Scale, 3. And 4. Mother/Father Scale 5. Teacher Scale, 6. Confidence in Learning Mathematics Scale, 7. Mathematics Anxiety Scale, 8. Effectance Motivation Scale in Mathematics, and 9. Mathematics Usefulness Scale. Later, several others developed other measuring instruments based on the Fennema-Sherman scale. The attitude scales mentioned above were well-known scales used by many western researchers to measure the attitude toward mathematics. But the western scales on attitude towards

mathematics were unsuitable in the Indian context since the attitude scales also measured personality dimensions like motivation, interest, self-confidence, etc., together with attitude.

In the Indian context, there are a few psychological measuring tools to measure only the students' Attitudes Towards Mathematics. In 2011, Lalit and Singh developed a bilingual scale consisting of 24 items with four dimensions to measure students' Attitudes toward mathematics. Later, in 2012, Gakhar and Rajini developed an Attitude Towards Mathematics Scale (ATMS). In 2015, Sivapragasm developed and validated Attitude Scale Towards Mathematics (ASTM) to investigate the attitude of students in Palani Educational District- Tamil Nadu. In 2018, Samsujjaman developed and validated the Attitude of Secondary level students toward the geometry scale to collect the data for the study in West Bengal. Kundu and Kar (2018) developed a tool with 40 items, validated, and reliability was found to determine the Attitude of Secondary School Students toward mathematics. The Indian tools had the attitude as one of the subscales, whereas it also measured other dimensions rather than only the attitude towards mathematics. Hence, to focus on students' Attitudes Towards Mathematics per se for the Indian students, the investigator had made an effort to develop a tool to measure only the Attitude Towards Mathematics of high school students in India.

Theoretical background

Ajzen (1993) conceptualized that an attitude was the amalgamation of three separately measurable components known as affect (A), behaviour (B) and cognition (C). According to Syyeda (2016), these three components are interrelated and contribute to the overall attitude to learning mathematics. Thus, people's attitudes determine their behaviour towards objects, situations, and people. According to Joseph (2013), attitude is a belief that reflects individuals' opinions and feelings manifested in behaviour. The ABC attitude model is also known as Tripartite Model. The Affective component refers to the feelings or emotions associated with, or one has toward an attitude object (ex: snake). The Behaviour component refers to how one behaves or engages when exposed to an attitude object. The Cognitive component refers to the thoughts or thinking that leads one to an attitude. Hence, an attitude refers to a learned tendency of a person to respond positively or negatively towards an object, situation, concept, or person. When students feel learning mathematics is pleasurable and believe in their ability to learn the subject well, cognition helps them perceive that mathematics is useful. Thus, the students exhibit their behaviour through interest, motivation, commitment, and performance.

Objectives of the Study

The objectives of the study were to:

1. Develop a scale to assess the Attitude Towards Mathematics of High School students.
2. Identify factors of the Attitude Towards Mathematics Scale.
3. Establish reliability and validity for the Attitude Towards Mathematics Scale.

2. Method

Steps involved in test construction

After stating the importance of the Attitude Towards Mathematics Scale and the objectives, the investigator had carried out the following steps to develop and validate the instrument:
1. Planning 2. Item generation 3. Screening of items 4. Validity 5. Reliability 6. Normative information

2.1Planning

The primary aim of developing the Attitude Towards Mathematics Scale was to measure the students' Attitude Towards Mathematics. While developing this scale, the researcher kept in mind all the existing Indian and western tools on attitude towards mathematics. To focus only on the students' Attitude Towards Mathematics per se, the researcher had taken meticulous care to see that the instrument measures what it is supposed to measure.

2.2 Item Generation

The first step in developing the mathematics attitude scale was carefully identifying and selecting items relating to mathematics attitude. The researcher generated the items related to attitude toward mathematics with the information gathered from textbooks, existing tools and specimen items given in various research articles on mathematics attitude, and suggestions from three groups of 6 students each. The researcher extensively reviewed the literature on attitudes towards mathematics before generating the items. The carefully selected items made it simple, relevant, clear,

and not double-barrelled. Finally, after carefully studying several scales developed by both Indian and foreign authors, the investigator constructed a scale ATMS comprising 34 items. The present scale consisted of both positive and negative statements. The investigator used Likert's 4-point rating scale to determine students' attitude levels concerning mathematics. Depending on the statements' wordings, an answer of Strongly Disagree to Strongly Agree will indicate an individual's most favourable response. The scale's positive and negative statements prevented the students from giving the same answer. The researcher gave the Attitude Towards Mathematics Scale with 34 items to four experienced mathematics teachers teaching in high schools for more than five years. After the recommendations from the teachers, the researcher removed six statements with similar content and five irrelevant statements. Finally, the Attitude Toward Mathematics Scale consisted of 23 items to be given to the experts.

3. Screening of the Items

The Attitude Towards Mathematics Scale was given to six psychologists to check and offer their expert opinion on each item, whether it is relevant, not relevant or needs modification. Accordingly, the researcher modified some of the statements:

Example:

1. I get low marks as I dislike mathematics

Modified as: I get low marks in mathematics because I do not like the subject.

2. I dislike solving mathematical problems in the classroom and outside the class.

Modified as: I do not show much interest in solving problems in mathematics.

3. Whenever people talk about mathematics, I do not have the interest to participate.

Modified as: I do not like to discuss the subject of mathematics with others.

The investigator also removed three irrelevant items according to the suggestions given by the experts.

Example:

1. If I have a choice, I do not prefer to study mathematics.
2. I like to study mathematics as it will help me get a good job.
3. I like if mathematics is made a compulsory subject.

Thus, the final Attitude Towards Mathematics Scale had only 20 statements ready to test the inter-item reliability.

4. Validity

Face Validity

The face validity of the Attitude Towards Mathematics Scale was established by the judgements given by mathematics teachers and the representatives of class 9 and 10 students. They objectively assessed all the 20 items for clarity, understanding and relevance. The investigator incorporated the suggestions given by the teachers and the students.

Content Validity

The content validity was determined from the consent of the psychologists and research scholars. The experts rated the items on their simplicity (whether the statement is easy to understand and straightforward), clarity (whether the statements are clear without ambiguity), relevance (whether each statement relates to what is supposed to measure), repetition (whether any item repeated) and appropriateness (to what extent each item is suitable for the scale) of the items.

5. Reliability

Reliability denotes the degree to which scores from a test are stable, and results are consistent.

Inter-Item Reliability: Inter-item reliability was established using Cronbach's alpha. Two hundred and six students from two schools in Chennai participated in the preliminary survey. The students were administered the questionnaire and tabulated to establish inter-item reliability for the Attitude Towards Mathematics. The Cronbach Alpha for the Attitude Towards Mathematics Scale was 0.84. The investigator deleted no items to improve the alpha value and retained all the 20 items for further study to continue the statistical process of factor analysis.

Split-half reliability

The investigator established the reliability of the scale through Split-half reliability. The split-half reliability of the attitude towards mathematics scale was 0.81. The split-half

reliability coefficient shows that the scale is highly reliable.

Participants

Five hundred and eighteen students (245 males and 273 females) of 8^{th}, 9^{th} and 10^{th} classes from three schools of Nagaland, selected randomly, participated in the study. Most of the students were between 13 to 16 years of age and could understand and speak well in English.

6. FACTORIAL VALIDITY

Exploratory Factor Analysis

The researcher personally administered the questionnaire to the students directly and analyzed the data. Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) gave the sampling adequacy for factor analysis. The Kaiser-Meyer-Olkin index is 0.923; hence according to Carpenter (2018), if KMO is > 0.5, which suggests high suitability for conducting factor analysis. In the three items (statements 2, 9, 12), factor loadings were less than 0.4, and for one of the items (the statement 20), the factor loading was greater than 0.8; hence the researcher deleted those four items to increase the value of Cronbach's Alpha. Thus, the Attitude Towards Mathematics Scale was reduced finally from 20 items to 16 items. The reliability coefficient Cronbach's Alpha for the scale was 0.893, the Split-Half coefficient was 0.873, and the Kaiser Meyer Olkin measure of sampling adequacy was 0.923. The varimax rotation in the factor analysis yielded three factors: a negative attitude towards mathematics, a tendency to avoid mathematics and a positive attitude towards mathematics. Thus, the 16 items of the Attitude Towards Mathematics were retained for the final study (Ref: Appendix **3**).

7. Normative Information

a) Tool Description

The Attitude Towards Mathematics Scale (ATMS) measures students' attitudes toward the subject of mathematics. The three factors of the scale reflect the negative attitude towards mathematics, tendency to avoid mathematics and positive attitude towards mathematics. The ATMS with 16 items is a 4-point Likert scale with options, Strongly Disagree to Strongly Agree and values ranging from 1 to 4. The scale also has a reverse scoring option from Strongly Disagree to Strongly Agree and the values ranging from 4 to 1, to obtain specific responses from the respondents. Students usually tend to give neutral answers, which may not be accurate and valuable for the data analysis. Hence, instead of a 5-point Likert scale, a 4-point Likert scale is used for the benefit and accuracy of the study. Of the 16 items, six items (i.e., 2, 3, 6, 7, 12 and 13) on a negative attitude towards mathematics, five items (i.e., 5, 8, 10, 15 and 16) on a tendency to avoid mathematics and five items (i.e., 1, 4, 9, 11 and 14) are on positive attitude towards mathematics (Ref: Appendix **1** & Appendix **2**). The participants respond to the scale based on their personal experience and how much it applies to them.

b) Scoring and Interpretation

In the 4-point Likert scale, items 2, 3, 5, 6, 7, 8, 10, 12, 13, 15 and 16 were scored with the options ranging from Strongly Disagree (SD=1), Disagree (D=2), Agree (A=3) and Strongly Agree (SA=4). The investigator reversely scored items 1, 4, 9, 11, and 14 with the options ranging from Strongly Disagree (SD=4), Disagree (D=3), Agree (A=2) and Strongly Agree (SA=1). The responses are summed up to acquire a composite score. Thus, scores of the Attitude Towards Mathematics range from 16 to 64. Accordingly, a high score indicates that the person has a negative attitude and a low score indicates that the person has a positive attitude towards mathematics.

c) Procedure of administration

The participants were given the Attitude Towards Mathematics Scale, and the investigator explained that the scale had 16 items with options of Strongly Disagree (SD), Disagree (D), Agree (A), and Strongly Agree (SA). The following instructions were given:

1. Read the items carefully, understand them well, and choose only one response from the options: Strongly Disagree, Disagree, Agree, and Strongly Agree.
2. Put a (✓) mark in the appropriate box according to what was most accurate and relevant for you regarding your attitude towards mathematics.
3. There is no right or wrong answer and no specific time limit
4. Respond spontaneously and honestly.

d) Discussion

Many researchers agreed upon the role of Attitude as contributing factor to high or low achievements (Mbuti, 2017). A positive attitude can improve students learning. On the other hand, a negative attitude reduces the students

learning and hinders the learning outcome (Joseph, 2013). The students' environmental factors influence the individual's cognitive, behavioural, and attitudinal learning outcome. The newly constructed tool is of immense help to the students, teachers, and counsellors to determine whether the students avoid mathematics or have positive or negative attitudes towards mathematics. The management could become aware of the importance of students' attitudes towards mathematics to improve their performance

A negative experience of getting low marks in a mathematics exam makes an individual respond negatively in the mathematical class or solving mathematical problems. This attitude is known as a learned predisposition. In this situation, the individual assumes that even if they put in a lot of effort, it will not help them since mathematics is not their favourite subject. Consequently, they do not spend quality time studying mathematics or solving mathematics problems, which results in poor preparation for the examination. Thus, the first dimension of the Attitude Towards Mathematics Scale evaluates whether an individual tends to react unfavourably to the mathematical situation. The two highest factorial values for the first dimension are 0.782 and 0.682 for the statements 'I like to spend more time on other subjects than mathematic'; 'I do not like mathematics because I find it difficult to understand' which powerfully indicates the unfavourable attitude of the individual.

A student who likes mathematics is happy to discuss mathematics with others and feels comfortable in their company. Whereas someone who does not like mathematics or finds mathematics difficult loses interest, does not like calculation, and tries to avoid people who discuss mathematics. Thus, the second dimension of the Attitude Towards Mathematics Scale evaluates whether an individual tends to avoid mathematics class or mathematics examinations or discussions about solving mathematical problems. The two highest factorial values for the second dimension are 0.766 and 0.695 for the statements 'I tried to avoid people talking about mathematics'; 'I find it difficult to sit in the class during mathematics', which strongly indicates the avoidance attitude of the individual towards mathematics.

If a student is interested in mathematics, he will indisputably like the subject, and at times he may also like mathematics more than the other subjects. The reason could be that mathematics helps one to think systematically and orderly. This positive attitude will be displayed in their behaviour when the individual uses most of his free time to study mathematics, his favourite subject. The third dimension of the ATMS facilitates this process to determine whether one has or cultivates a positive attitude towards mathematics. The two highest factorial values for the third dimension are 0.757 and 0.669 for the statements 'I like to use my free time to study mathematics'; 'I like mathematics very much', which shows the individual's positive attitude towards mathematics.

The existing Western and Indian tools on attitude towards mathematics measure: self-confidence, mathematics anxiety, enjoyment of mathematics, motivation, the usefulness of mathematics, and value of mathematics. Instead, the present tool (ATMS), with its three dimensions, focuses on evaluating the students' attitude toward mathematics, whether favourable or unfavourable, or whether they like or dislike the subject of mathematics as per the operational definition of Neale (1969). Hence, the present tool on Attitude Towards Mathematics differs from other tools.

Finally, everyone in the field of education - the educators, mathematics teachers, curriculum designers, and parents, must make serious efforts to develop a positive attitude towards mathematics among students. It will help them to like the subject and succeed in their future career.

e) Future Research

The Attitude Towards Mathematics Scale would provide new avenues for future research in mathematics education, career orientation, STEM education and other research areas. The additional psychometric validation of the test and re-test, Exploratory Factor Analysis (EFA) and the Confirmatory Factor analysis (CFA) could be carried out to provide robustness of the scale. Future research could include other classes to ascertain students' attitudes towards mathematics, achievement and anxiety in mathematics.

8. Conclusion

The newly constructed Attitude Towards Mathematics Scale is highly reliable and valid. It measures students' negative attitudes toward mathematics, their tendency to avoid mathematics, and their positive attitude toward

mathematics to like the subject of mathematics. Attitude contributes to the success of students in their educational field. Hence, Teachers must make all the efforts possible in the classroom to help the students have a positive attitude to succeed in mathematics.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest concerning this research article, authorship, and publication.

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Appendix I

ATTITUDE TOWARDS MATHEMATICS SCALE
(Factors and Factor loadings)

Item No.	**Factors and Items**	**Factor 1** Negative attitude towards mathe-matics	**Factor 2** Tendency to avoid mathe-matics	**Factor 3** Positive attitude towards mathe-matics
2	I do not show much interest in solving problems in mathematics.	**.595**		
3	I do not like mathematics because I find it difficult to understand.	**.682**		
6	Mathematics is not my favourite subject.	**.598**		
7	I like to spend more time on other subjects than mathematics.	**.782**		
12	I do not like mathematics subject.	**.587**		
13	I get low marks in mathematics because I do not like the subject.	**.554**		
5	I do not like to discuss the subject of mathematics with others.		**.520**	
8	I lose interest in my studies because of mathematics.		**.678**	
10	I do not like calculations in mathematics.		**.497**	
15	I try to avoid people talking about mathematics.		**.766**	
16	I find it difficult to sit in the class during mathematics.		**.695**	
1	Mathematics is an interesting subject.			**.521**
4	I like mathematics very much**.**			**.669**
9	I like mathematics more than other subjects.			**.657**
11	I like to use my free time to study mathematics.			**.757**
14	I like mathematics as it helps me to think Systematically.			**.561**

Appendix 2

Descriptive Statistics (Factor 1)

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ATM 3	518	1	4	2.42	.837	-.120	.107	-.639	.214
ATM 4	518	1	4	2.63	1.033	-.133	.107	-1.137	.214
ATM 7	518	1	4	2.74	.966	-.371	.107	-.804	.214
ATM 8	518	1	4	2.83	.944	-.361	.107	-.800	.214
ATM 15	518	1	4	2.25	.940	.228	.107	-.873	.214
ATM 16	518	1	4	2.33	.975	.313	.107	-.873	.214
Valid N (listwise)	518								

Descriptive Statistics (Factor 2)

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ATM 6	518	1	4	2.27	.929	.246	.107	-.803	.214
ATM 10	518	1	4	1.81	.822	.866	.107	.271	.214
ATM 13	518	1	4	2.12	.874	.412	.107	-.517	.214
ATM 18	518	1	4	1.85	.814	.771	.107	.148	.214
ATM 19	518	1	4	1.98	.873	.721	.107	-.049	.214
Valid N (listwise)	518								

Descriptive Statistics (Factor 3)

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ATM1R	518	1	4	2.23	.861	.469	.107	-.323	.214
ATM5R	518	1	4	2.68	.869	-.181	.107	-.637	.214
ATM11R	518	1	4	2.76	.898	-.466	.107	-.469	.214
ATM14R	518	1	4	2.75	.864	-.313	.107	-.519	.214
ATM17R	518	1	4	2.38	.869	.194	.107	-.611	.214
Valid N (listwise)	518								

Appendix 3

ATTITUDE TOWARDS MATHEMATICS SCALE

Given below are statements on how much you like the subject of mathematics. Read each statement carefully and give your honest response indicating to what extent it is applicable (or) related to you. There are no right or wrong responses. Do not spend much time on any statement but give your immediate response that occurs to you. Please respond to all the statements and do not omit any statement. Please rate yourself on a scale from 1 to 4. Kindly circle the one response closest to you using the rating scale.

If you **strongly disagree** with the statement, then circle number **1**
If you **disagree** with the statement, circle number **2**
If you **agree** with the statement, circle number **3**
If you **strongly agree** with the statement, circle number **4**

No		Strongly Disagree	Disagree	Agree	Strongly Agree
1	Mathematics is an interesting subject.	1	2	3	4
2	I do not show much interest in solving problems in mathematics.	1	2	3	4
3	I do not like mathematics because I find it difficult to understand.	1	2	3	4
4	I like mathematics very much**.**	1	2	3	4
5	I do not like to discuss the subject of mathematics with others.	1	2	3	4

6	Mathematics is not my favourite subject.	1	2	3	4
7	I like to spend more time on other subjects than mathematics.	1	2	3	4
8	I lose interest in my studies because of mathematics.	1	2	3	4
9	I like mathematics more than other subjects.	1	2	3	4
10	I do not like calculations in mathematics.	1	2	3	4
11	I like to use my free time to study mathematics.				
12	I do not like mathematics subject.	1	2	3	4
13	I get low marks in mathematics because I do not like the subject.	1	2	3	4
14	I like mathematics as it helps me to think systematically.	1	2	3	4
15	I try to avoid people talking about mathematics.	1	2	3	4
16	I find it difficult to sit in the class during mathematics.	1	2	3	4