

Impact of Peer-Tutoring Strategy on Students' Performance in Geometry Among Senior Secondary Schools in Katsina Metropolis, Katsina State - Nigeria

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Abstract

This study investigated the impact of Peer-tutoring strategy on students' performance in Geometry among senior secondary schools in Katsina Metropolis, Nigeria. In this study, three (3) research questions were raised and answered. Also, three (3) hypotheses were formulated and tested at 0.05 level of significance. The study adopted the quasi-experimental non-randomized pre-test-post-test control group design. The population comprised of eleven thousand, seven hundred and fifty-five (11755) Senior Secondary II students consisting of six thousand, three hundred and thirty-four, (6,334) while male students are five thousand, four hundred and twenty-one (5,421) female students offering Mathematics in (12) public schools of Katsina Metropolis. two instruments namely Geometry Achievement Test (GAT) which consists of three sections, section A, Bio data, Section B measured Performance and Section C measured Understanding and the other instrument is Students Attitude Questionnaire (SAQ) which consists of 10 items, all were constructed by the researcher and used to collect data for this study.

Keywords: *Impact, Peer-tutoring, Strategy, Metropolis*

Intorduction

Education is an attempt to change human behaviour through the process of teaching and learning. It is a social institution that seeks to bring about those behavioural changes which are considered worthwhile and desirable by the society. The purpose of education is likely to be met when the teacher takes the responsibility to transfer the knowledge to the best of his capability. To teach is to help someone learn something but teaching is more than presenting information or even ideas. It also includes guiding student learning by means of such activities as analysing, probing, examining and discovering leading to reflective thinking and skill development. Hence, this brings about Science Education (Eremina, 2016).

Peer-tutoring is an instructional strategy for teaching which refers to delivery of lesson through grouping of students in form of tutor and tutees. It is a structured cooperative learning program. Peer-tutoring was developed by Fuchs and Simmon in 2001 as pointed out by Anthony Uwanekezi and Williams (2018). It was derived from the Fuchs' interest in developing a peer-mediated instructional strategy that incorporated elements of other research-based methods. Panitz (2013) opined that, peer-tutoring is a teaching strategy that uses students as tutors. The student pairs might work on academic, social, behavioural, functional or even social skills. There are many different ways to pair students, such as by ability level, skills mastered, or age. The following model descriptions will assist in selecting the correct model based on certain criteria. Peer-tutoring has been extensively researched as

an impactful strategy to engage students and promote academic success Williams and Akpan (2017).

Academic achievement and performance have mostly been used interchangeably. Both of these concepts are terms in educational measurement and evaluation used to determine the level of behavioural objectives internalized by students. Performance is the ability and capability of a student to reproduce correctly from memory what he/she has learnt. Ozturk and Serap (2014) defined academic achievement as how well a student completes his or her tasks and studies. Students ought to be able to demonstrate mastery of what he/she has learnt. The outcome of students' demonstrative skill and the recalling of what have been learnt is known as performance. Mathematics is a bedrock of all sciences. It is compulsory for all secondary school students and a pass at credit level in ordinary level Mathematics examination is one of the requirements for gaining admission in to any tertiary institution to study science related and Mathematics courses. Every man needs a certain knowledge in Mathematics in order to survive in this highly technological and complex society. Therefore, the use of Mathematics knowledge spreads across all spheres of human endeavor and as such, there is no subject, field of study or any profession that does not make use of some form or order of Mathematics. Mathematics education therefore, is a dynamic instrument that can be used to bring about positive changes in any nation and in the life of its citizens. Hence, recognition attached to it cannot be over emphasized (Musa, 2016).

Statement of the Problem

Poor performance in Mathematics particularly in Geometry is attributed to teachers' non-usage of appropriate teaching methods (Paula, 2020). For effective learning to occur, classroom experiences presented by teachers should be made meaningful to the students. Therefore, teachers often struggle to make choice pertaining instructional method to use in their classrooms which will improve students' performance. The task of selecting suitable instructional method that will serve these purposes is found not easy for the teachers.

Students' poor understanding may be due to inappropriate used of instructional method adopted by teachers in teaching Geometry. This is because there is no single method that works well for every learner and for every situation. It is the duty of every teacher to identify suitable instructional strategy for his class, bearing in mind the topic, the students' capability and teachers' familiarity with the strategy to enhanced learners' understanding. Teacher's poor attitude discourages the interest of students to learn Geometry. Such teachers blamed students' inability to recall geometrical concepts, formulae and theorems. Students' poor perception in learning Geometry may greatly affect their performance due to use of unsuitable instructional method by teachers. This, among other factors, immensely contributes to students' poor performance in geometry and Mathematics generally. This calls for the urgent need to explore and suggest effective instructional strategies that have been found to improve students' performance. To overcome these problems, there is a need to study Impact of peer-tutoring strategy on students' performance in geometry among senior secondary schools in Katsina metropolis, Katsina state, so that later the study may have extended to cover the political zones of the state and entire country.

Objectives of the Study

The objectives of this study were to:

1. Investigate the impact of peer-tutoring strategy on students' performance in Geometry among senior secondary schools in Katsina metropolis.

2. Find out the impact of peer-tutoring strategy on students' understanding in Geometry among senior secondary schools in Katsina metropolis.
3. Determine the impact of peer-tutoring strategy on students' attitude towards Geometry among senior secondary schools in Katsina metropolis.

Research Questions

The following research questions were raised:

1. What is the impact of peer-tutoring strategy on students' performance in Geometry among senior secondary schools in Katsina metropolis.?
2. What is the impact of peer-tutoring strategy on students' understanding in Geometry among senior secondary schools in Katsina metropolis.?
3. What is the impact of peer-tutoring strategy on students' attitude towards Geometry among senior secondary schools in Katsina metropolis.?

Research Hypotheses

The following research hypotheses were tested at 0.05 level of significance:

1. There is no significant impact of peer-tutoring strategy on students' performance in Geometry among senior secondary schools in Katsina metropolis.
2. There is no significant impact of peer-tutoring strategy on students' understanding in Geometry among senior secondary schools in Katsina metropolis.
3. There is no significant impact of peer-tutoring strategy on students' attitude towards Geometry among senior secondary schools in Katsina metropolis.

Theoretical Framework

Theoretical framework can be seen as any empirical theory of social and psychological processes that can be used to explain phenomena. Peer-tutoring strategy was the learning strategy adapted in this study. There are different perspectives regards to peer tutoring such as social constructivism, behaviourism, cognitivist among others, but the emphasis in this study is centred on the approach that most of the researchers agreed to in peer tutoring dynamics, which is social constructivism. Vygotsky (1978) introduced his socio-cultural theory which clarified two levels of development i.e., the actual and potential levels. The actual level refers to the ability of the student to independently solve a problem whereas the potential level focuses on Zone of Proximal Development (ZPD) which refers to the ability of the student to solve a problem with the guidance of a more experienced peer or teacher. Vygotsky believed that peer collaboration encourages learners to assist one another and discussed openly about their ideas and opinions which is considered as a powerful tool for developing a more reflective learning and also makes the learning more meaningful, easier, manageable, effective and efficient. Vygotsky's learning theory, has direct implication to peer-tutoring teaching strategy because it has social interaction which plays a fundamental role in the development of cognition and also theory seem to be paramount to the existing models of learning and development due to its pursued multidimensional approach which pays special heed to the cognitive, affective, social, and contextual aspects of change (Shabani, 2016). However, Galloway (2015) reiterates the fact that social interaction with cultural artifacts forms the most important part of learner 's psychological development. Cultural tools or artifacts include all the things we use, from simple things such as a pen, spoon, or table, to the more complex things such as language, traditions, beliefs, arts, or science. The authors added that Vygotsky states in his genetic law of development that any higher mental function necessarily goes through an external social stage in its development

before becoming an internal, truly mental function. Thus, the function is initially social and the process through which it becomes an internal function is known as internalization. This also agrees with (Culatta, 2015) who opined that Individual development cannot be understood without reference to the social and cultural context within which it is embedded. Higher mental processes in the individual have their origin in social processes.

Methodology

A pre-test post-test quasi experimental design was adopted in this study using two groups (experimental and control), in order to determine the students' performance and understanding of the geometry the treatment and teaching tool place for six weeks also the treatment post-test was administered to the group to determine the impact of students' performance and understanding the research design illustration is presented in Figure 1:



Where

- | | |
|--|---|
| EG ₁ Experimental Group One | X ₁ Treatment using Peer-tutoring strategy |
| CG Control Group | X ₀ No treatment (Conventional Lecture method) |
| O ₁ Pre-test | O ₂ Post-test |

Population of the Study

The population is made up of all senior secondary schools in Katsina metropolis, there are (12) twelve senior secondary schools in Katsina metropolis. These schools have six thousand, three hundred and thirty-four, (6,334) male students and five thousand, four hundred and twenty-one (5,421) female students making of a population of eleven thousand, seven hundred and fifty-five (11755) students. Senior Secondary School II were used in the study, the reason for taking senior secondary schools II is that, this category of students has completed SSI, they are stable and familiar with the school environment, the instructors and the topics selected form part of their curriculum. Below is the breakdown of the population.

Table 1. Population of the Study

SN	Wards within Total Metropolis	No. of Schools	Male	Female
1.	Wakilin Gabas 4730	6	2,453	2,277
2.	Wakilin Yamma 1,856	2	890	966
3.	Wakilin Kudu 2,577	2	1,705	872
4.	Wakilin Arewa	1	552	258
5.	Kangiwa 1,782	1	734	1,048
	Total 11,755	12	6,334	5,421

Source: Katsina State Ministry of Education, (2022)

Sample and Sampling Techniques

For the sample of the study, three (3) schools were randomly selected from the population of twelve (12) schools. From each school, forty (40) students were randomly selected making a

sample of one hundred and twenty (120) students. These are the students who really took part in the study. The table below shows the sample:

Table 2.

SN	Schools	Group	Students
1.	School A	Experimental	20
		Control	20
2.	School B	Experimental	20
		Control	20
3.	School C	Experimental	20
		Control	20
Total	3		120

Instruments

Two instruments were constructed namely; Geometry Achievement Test (GAT) (see Appendix A) which has three sections; section A, Bio Data, section B measure performance and section C measure understanding, Meanwhile, it consists of two sections, these are section A and B. Section A contained respondents Bio-data while section B measure performance which is made up of ten (10) multiple choice items in Geometry with four options lettered A to D to choose the correct answer. Also, section C measured Understanding, it consists ten (10) multiple choice items in Geometry.

The other instrument is Students Attitude Questionnaire (SAQ) (see Appendix B). it consists ten (10) items which measured students' attitude towards Geometry with four options Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD).

Validity of the Instruments

Expert validation method was used. Two PhD holders and senior lecturer of Mathematics education validated the instruments. All corrections they made were effected

Reliability of the Instruments

The researcher used split half coefficient technique which reflects the correlations between two halves of a set of items, Cronbach's alpha is computed in terms of the average inter-correlations among the items measuring the concept. The instrument was found reliable at 0.78 indicating strong positive correlation and this indicated that the instrument is reliable enough to use in this study.

Procedure for Data Collection

Data for the study was collected through the administration of pre-test and post-test and collection phase lasted for six (6) weeks. The researcher and the researcher administered a pre-test to the students in both the experimental and control group using an instrument named Geometry Achievement Test (GAT) before the commencement of the treatment. Meanwhile, the pre-test scores were served as a basis for comparing students' Performance in Mathematics test before treatment. The experimental groups were taught using Peer-tutoring strategy while the control group was taught using the lecture method by the researcher. After the treatment, a post-test was administered to both the experimental and the control groups. The scripts were collected, marked and scored to make comparison between the groups.

Procedure for Data Analysis

The descriptive statistics which involved the use of mean and standard deviations used to answered questions while inferential statistical tool involving t-test used in testing the null hypotheses formulated. All the hypotheses were tested at 0.05 level of significance. The statistical package for the social sciences (SPSS) computer analysis software was used for all data analysis in this study.

Data Presentation and Analysis

The data collected were analysed based on the research questions and the null hypotheses postulated. The results are presented in Tables followed by their respective interpretations as shown below.

Research Question One

What is the impact of peer-tutoring strategy on students' performance in Geometry among senior secondary schools of Katsina metropolis.?

Table 3: Mean and Standard Deviations of student's performance

Groups	N	Mean	Std. Dev.	Mean Difference
Experimental Group	60	32.17	5.99	
Control	60	20.10	5.84	12.7

Source: Researcher's Fieldwork, 2022.

Table 3 presented the Mean and Standard Deviations Performance of experimental group and control group. From the results, students taught using peer-tutoring strategy scored a mean of 32.17 and standard deviations of 5.99, while students taught using lecture method scored a mean of 20.10 and standard deviations of 5.84. Students taught using peer-tutoring strategy recorded the highest mean score than students exposed to lecture method. Which means that students taught using peer-tutoring perform better than those taught using traditional method.

Research Question Two

What is the impact of peer-tutoring strategy on students' understanding in Geometry among senior secondary schools of Katsina metropolis.?

Table 4: Mean and Standard Deviations of students' understanding

Groups	N	Mean	Std. Dev.	Mean Difference
Experimental	60	23.51	4.65	2.32
Control	60	21.19	7.24	

Source: Researcher's Fieldwork, 2022.

Table 4: presents Mean and Standard Deviations of students' understanding of experimental and control groups. From the results, students taught using peer-tutoring strategy scored a mean of 23.51 and standard deviations of 4.65, while students taught using control method scored a mean of 20.18 and standard deviations of 7.24. Students taught using peer-tutoring strategy recorded the highest mean score than those taught using lecture method. Which means that students taught using peer-tutoring perform better than those taught using traditional method.

Research Question Three

What is the impact of peer-tutoring strategy on students' attitude towards Geometry among senior secondary schools of Katsina metropolis?

Table 5: Mean and standard deviation of students' attitude

No	Items	Agree	Disagree	Decision
1.	I am not interesting in studying Geometry	15	45	Rejected
2.	I really like Geometry.	52	18	Accepted
3.	I am able to solve Geometry problems without too much difficulty.	35	25	Accepted
4.	I learn Geometry easily.	37	23	Accepted
5.	I approach Geometry problem with a feeling of hesitation.	20	40	Rejected
6.	I learn Geometry easily	33	27	Accepted
7.	I am able to solve Geometry problems without too much difficulty.	41	19	Accepted
8.	I am always confused in my Geometry class.	14	46	Rejected
9.	Geometry is important in everyday life	43	17	Accepted
10.	I am not interesting in studying Geometry	45	15	Rejected

Source: Researcher's Fieldwork, 2022.

From Table 5: 10 items representing students' attitude towards Geometry was indicated positive attitude towards Geometry. Evidence from the results revealed that students have positive attitude towards Geometry as a topic in senior secondary schools in Katsina Metropolis. Students feel that Geometry is interesting and have good feeling towards Geometry, learn Geometry easily and Agree that Geometry is important in everyday life.

Testing Null Hypothesis One

There is no significant impact of peer-tutoring strategy on students' performance in Geometry among senior secondary schools of Katsina metropolis.

Table 6: t-test Analysis of Performance of students

Groups	N	Mean	Std. Dev.	T	Df	P-Value	Decision
Experimental Group	60	21.49	6.00	8.838	118	.000	Significant
Control	60	12.52	5.85				

Source: Researcher's Fieldwork, 2022.

Table 6 presents t-test Analysis of Performance of students taught using peer-tutoring strategy. From the results, the t-value recorded is 8.838 while the p-value observed at degree of freedom of 136 is 0.00. P-value observed is less than 0.05 and therefore null hypothesis which stated that there is no significant difference in the performance students taught using peer-tutoring strategy and those taught using traditional strategy is rejected.

Testing Null Hypothesis Two

There is no significant impact of peer-tutoring strategy on students' understanding in Geometry among senior secondary schools in Katsina metropolis.

Table 7: t-test Analysis of students' Understanding

Groups	N	Mean	Std. Dev.	T	Df	P-Value	Decision
Experimental	60	22.52	4.75	1.697	118	.094	Not significant
Control	60	20.18	7.16				

Source: Researcher's Fieldwork, 2022.

Table 7 presents t-test Analysis of students' understanding taught using peer-tutoring strategy. From the results, the t-value recorded is 1.69 while the p-value observed at degree of freedom of 58 is 0.094. p-value observed is greater than 0.05 and therefore null hypothesis which stated that there is no significant difference in the understanding of students taught using peer-tutoring strategy is retained.

Testing Null Hypothesis Three

There is no significant impact of peer-tutoring strategy on students' attitude towards Geometry among senior secondary schools in Katsina metropolis.

Table 8. t-test analysis of students' attitude

Resp.	N	\bar{X}	SD	Df	St. error	t-cal.	t – critical	Sig. level	Decision
Experimental	60	2.42	0.1214	118	0.02559	0.435	1.960	0.05	rejected
Control	60	2.37	0.1025						

Source: Researcher's Fieldwork, 2022.

From Table 8 the calculated value of t- ratio, which is 0.435, is less than the critical value of 1.960. Therefore, the null hypothesis which state that there is no significant impact of peer-tutoring strategy on students' attitude towards Geometry among senior secondary schools in Katsina metropolis. is accepted. this implies that there is no significant difference between student's attitude towards Geometry concept in Katsina metropolis.

General Discussions

Finding number one indicated that There was significant impact of peer-tutoring strategy on students' performance in Geometry among senior secondary schools in Katsina metropolis.

This finding agrees with the findings of Ameh et al (2012), Iline (2013), and Musa (2015), that peer tutoring method has significant impact on students' academic performance. Many other previous studies conducted on peer-tutoring method also proved the efficacy of this teaching method (Daluba2015), Muhammad et al, (2016) and Inuwa et al, (2018). This finding is therefore not a surprise because the formative assessment used as diagnostic tool do not only help weak learners obtain instructional objectives but it also helps to bridge the gap between fast and slow learners (Guskey, 2017).

Finding number two indicated that There was significant impact of peer-tutoring strategy on students' understanding in Geometry among senior secondary schools in Katsina metropolis.

This finding corroborates with the findings of Anthony, Muhammad (2018), Nwanekezi and Cheta (2018), Agu, et al (2019), and Zakari, (2019), that peer-tutoring approach has

significant effect on students' understanding in Geometry. This finding is not shocking because, collaborative learning has been theorized as a group-based learning process where students can reach their level of potential development through positive interdependency which characterized the model (Rabia, Samuel & Atamonokhai 2019).

Evidence from the results revealed that students have positive attitude towards Geometry as a topic in senior secondary schools in Katsina Meteropolis. Students feel that Geometry is interesting and have good feeling towards Geometry, learn Geometry easily, the results of this study corroborate the study of other studies on students; attitude and academic performance in Geometry such as that of Hussaini, Foong & Karmamr (2015) where positive attitude of students towards Geometry was found. The results further corroborate the studies of Sofeme & Hena (2015) on students' attitude towards science subjects in senior secondary schools in Adamawa State, Nigeria and that of Sakariyu, Tiawo & Ajagbe (2016) on secondary school students' attitude towards science in Ogun State where higher proportion of the students displayed positive attitude towards science.

Conclusion

The major cause of the poor performance, understanding attitude towards Geometry is attributed to the use of inappropriate instructional strategies adopted by the Mathematics teachers. However, this study provides an empirical support and confidence to peer-tutoring as efficient enough to improve students' Performance and understanding above the present level. Peer-tutoring strategy facilitates students' Performance better than the traditional lecture strategy. It is revealed that, the treatment given to group have significant impacts on performance though, students in the peer-tutoring performed higher than those in the control/lecture groups. It is hereby concluded that, peer-tutoring strategy has significant impact on the students' Performance, understanding and attitude in Geometry than the traditional lecture method.

Recommendations

Based on the findings in chapter four and the conclusions of the study, the following recommendations are made:

1. Teachers of Mathematics should expose students to peer-tutoring strategy in order to encourage social interaction, active engagement and positive interdependence among learners.
2. Workshops and seminars for teachers should be organized by the Katsina state Ministry of Education on the use of peer-tutoring strategy in teaching Mathematics.
3. The Federal Government of Nigeria through its agencies such as the State Ministries of Education, Teacher Training Institutions and professional bodies such as MAN, NTI and STAN should organize a special re-training, workshops, and seminars to Mathematics teachers on peer-tutoring strategy.

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APPENDIX A

GEOMETRY ACHIEVEMENT TEST (GAT)

Section A Personal Information

Name of School:

Name of Student.....

Class.....

Gender..... Time: 1hr 15mins

Instructions: Attempt all the questions in Section B and C by circling the correct option from the given options. letter A-

D taken as where applicable. Take $\pi = \frac{22}{7}$

Section B

1. A cube has a length of 6cm and its surface area, Find its surface area?

- a. $226cm^2$ b. $72cm^2$ c. $202cm^2$ d. $216cm^2$

2. A closed match box has dimension 5.5cm by 3.5cm. and correct to the nearest whole number, the surface area of the box.

- a. $66cm^2$ b. $33cm^2$ c. $29cm^2$ d. $21cm^2$

A rectangular tank is in the form of a cuboid with base 1.2M by 1.5M there are 2700 liters of water in the tank. what is the depth of the water in the tank? a. 15.0M b. 2.7M c. 1.5M
d. 1.8M

A rectangular tank is 70cm long, 50cm wide and 40cm high. How many liters of petrol can it hold?

- a. 15200liters b. 1520liters c. 152liters d. 1420liters

5. The surface area of two cubes are in the ratio of their length?

- a. 4:7 b. 7:4 c. 3:7 d. 9:7

6. A cube has a surface area of $54cm^2$, find its volume

- a. $3cm^3$ b. $273cm^3$ c. $93cm^3$ d. $183cm^3$

The volume of two cubes are in the ratio 54:294, what is the ratio of their length? a. 3:5
b. 9:25 c. 2:5 d. 9:3

A cylindrical pipe is 28M long, its internal radius is 3.5cm with external radius is 5cm. calculate the volume of water in liters that the pipe can hold when full.

- a. 1080liters b. 107.8liters c. 1070liters d. 178.8litres

A cylindrical container has a volume of $4752cm^3$ if the container is 42m long, what is its diameter?

- a. 12m b. 24m c. 6m d. 3m

A closed cylindrical pipe is 20cm long with radius 10cm. Find the total surface area of the pipe to the nearest whole number.

- a. $1886cm^2$ b. $1257cm^2$ c. $2885cm^2$ d. $1885cm^2$

Section C

- The side opposite to the equal angles are
 - Not equal
 - adjacent
 - equal
- A straight line drawn from the vertex perpendicular to the side bisects that side and that vertical angles
 - Opposite
 - angle
 - adjacent
- If three or more parallel lines cut off equal intercepts on a transversal, then they cut off
intercepts on any other transversal
 - Equal
 - diagonal
 - straight
- The bisector of an angle in a triangle divides the opposite side in the ratio of the sides containing the
 - Circle
 - angles
 - triangle
- If the corresponding sides of triangles are in proportion, then the triangles are equiangular and similar
 - Two
 - three
 - four
- The sum of the exterior angles of a polygon is right angles, whatever the value of n. the exterior angles of a polygon are formed when any of its side is extended.
 - 7
 - 4
 - 9
- If two triangle have one angle of one equal to one angle of the other, and the sides about these angles are proportional, then the triangles are equiangular and similar
 - three
 - four
 - two
- A straight line drawn from the center of a circle to bisect a chord which is not as diameter is at to the chord
 - circle
 - chord
 - right angle
- Equal of a circle are distant from the Centre
 - angles
 - chords
 - triangles
- The in a semicircle is a right angle
 - angle
 - circle
 - chord

Section B Answers

- | | |
|------|-------|
| 1. D | 6. B |
| 2. A | 7. A |
| 3. C | 8. B |
| 4. C | 9. A |
| 5. C | 10. A |

Section C Answers

- | | |
|------|-------|
| 1. C | 6. B |
| 2. A | 7. C |
| 3. A | 8. C |
| 4. B | 9. B |
| 5. A | 10. A |

APPENDIX B

Student Attitude Questionnaire

Name of School:

Name of Student.....

Class.....

Gender.....

Instruction: Please tick among the following Likert scale options **SA** = Strongly Agree, **A** = Agree, **D** = Disagree and **SD** = Strongly Disagree.

No		SA	A	D	SD
1.	I am not interesting in studying Geometry				
2.	I really like Geometry.				
3.	I am able to solve Geometry problems without too much difficulty.				
4.	I learn Geometry easily.				
5.	I approach Geometry problem with a feeling of hesitation.				
6.	I learn Geometry easily.				
7.	I am able to solve Geometry problems without too much difficulty.				
8.	I am always confused in my Geometry class.				
9.	Mathematics is important in everyday life				
10.	I am not interesting in studying Geometry				