

# A Survey on the Self-efficacy of Geometry Learning among Grade 7 Students

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**Abstract:** As one of the four knowledge modules in junior high school, geometry is famous for its varied graphics and various methods. Combined with the current situation of mathematics and geometry learning in junior middle school, the self-efficacy of the seventh grade students was investigated and found that: (1) the seventh grade students' geometric self-efficacy is high, and there is a significant difference in gender.(2) There is a significant correlation between geometry self-efficacy and math performance, and there are some common problems in geometry learning among seventh graders. In view of these situations, the corresponding suggestions are put forward to improve the self-efficacy of seventh grade students in geometry learning.

## 1. Question Raising

American social psychologist Bandura put forward the concept of self-efficacy in 1977. Self-efficacy refers to the subjective judgment and belief held by individuals on whether they have the ability to successfully complete certain activities through efforts. Bandura's research shows that self-efficacy is one of the determinants of learning behavior. Students with a high sense of self-efficacy have strong confidence in learning, do not retreat from difficulties, full of confidence, and will focus on solving problems.

Bandura then pointed out that self-efficacy should be focused on specific areas. Therefore, mathematical self-efficacy has gradually become the object of research. Self-efficacy in mathematics refers to the situational and problem-oriented judgment of an individual on his or her ability to successfully complete a specific mathematical task or solve a specific mathematical problem. <sup>[1]</sup> After reviewing the literature, the author found that in recent decades, there were more than 100 research papers on mathematical self-efficacy. These studies mainly focus on the following aspects: one is the cultivation of mathematical self-efficacy, the other is to explore the relationship between mathematical self-efficacy and academic performance, learning anxiety, attribution style and other factors. For example, Hackett and Betz surveyed 262 college students and found that math self-efficacy was a better predictor of choosing a math-related major than math scores. <sup>[2]</sup> Du Xiaofeng and others investigated 23,133 8th grade students in central China, and the results showed that math self-efficacy partially mediated the relationship between math interest and learning persistence, and between math interest and math achievement. <sup>[3]</sup>

In general, most studies mainly focus on exploring the influencing factors of mathematical self-efficacy as a whole and the cultivation of students' self-efficacy, and rarely explore specific mathematical knowledge. I just got promoted to seventh grade. When I enter junior high school, I begin to systematically learn geometric proofs. If I can establish a relatively high sense of self-efficacy in the learning of mathematics and geometry, it will play a crucial role in the learning of the whole junior high school. In view of this, this paper takes the seventh grade students of a middle school in Jinan City as the survey object, studies the current situation of the seventh grade students' geometric self-efficacy, and explores suggestions to improve students' mathematical self-efficacy according to the research results.

## 2. Research Design

### 2.1. Research Methods

One is the literature research method. Using the Internet to search and collect the papers related to this mathematical self-efficacy, the relevant content was sorted out, analyzed and summarized. Understand the previous theoretical research results, on this basis, put forward some of their own thinking.

The second is the investigation and research method. Questionnaire was used for sampling survey. The questionnaire consists of two parts: The first part is an open-ended questionnaire, which mainly investigates students' subjective feelings in the face of relevant problems and allows students to express their true thoughts. The second part is the geometric self-efficacy questionnaire, which measures the scores of students' self-efficacy. Understand the current situation of students' geometry learning, and statistical analysis of the relevant data.

Third, the interview method. According to the collected questionnaire, the math teachers of the students surveyed were interviewed to understand the problems in the teaching process, so as to grasp the key of the problem more clearly.

### 2.2. Research Objects

The research object is the seventh grade students of a junior middle school in Jinan City, 60 people were selected by random sampling method, 60 questionnaires were distributed, 55 were recovered, and 55 were valid questionnaires. Among them, 28 were boys and 27 were girls.

### 2.3. Research Tools

#### Geometry Learning Self-efficacy Questionnaire

On the basis of Mathematics Self-efficacy Questionnaire, the geometry learning self-efficacy questionnaire was revised. A total of 32 statements about geometric self-efficacy attitude objects were formulated. It includes two dimensions, namely, students' basic sense of ability and sense of control in mathematics learning (see Table 1 for specific explanations). The statements were divided into positive statements and negative statements, and different scores were assigned to the answers to the two groups. Positive statements were scored 5 out of 100, 4 out of 100, 3 out of 100, 2 out of 100, and 1 out of 100, while negative statements were scored the other way around.

Table 1 Specific interpretation of the two dimensions.

Geometric sense of learning ability	1-16questions	Ability students on their own talent evaluation, is the feeling of the subjective judgment of the ability to learn and we can achieve good learning results of subjective feeling including "good learning results faith", "sense of goal achievement", "sense of talent", "positive expectations", "self confident".
Geometry learning control	17-32questions	Sense of control is the student mastery of their learning task and can control the topic learning behavior of subjective judgment, including the "sense of self doubt", "susceptibility to interference", "feeling bad about the environment", "powerless Sense", "sense of effort".

#### Open questionnaire

Because the concept of self-efficacy comes from an individual's subjective judgment of himself, open questionnaire is set up to allow students to express their true thoughts independently. The open-ended questionnaire consisted of three questions. First, students face the overall feeling of geometry. Second, let the students describe in the daily learning process for their own more difficult

geometric math problems; The third was to describe how they thought a person with confidence in geometry would behave.

### 3. Result Analysis

#### 3.1. Basic Statistical Analysis

Table 2 Scores of self-efficacy and each dimension.

	N	Minimum	Maximum	The mean	The standard deviation
Geometric self-efficacy	55	51.00	150.00	106.3636	19.24728
Sense of competence	55	25.00	74.00	53.0364	9.79411
A sense of control	55	26.00	76.00	53.3818	9.75153
Valid N(list state)	55				

It can be seen from the above table that the mean value of geometric self-efficacy of 55 students who participated in the test is 106.3636, the total score of geometric self-efficacy is 160, the passing level is 96, the excellent level is 128, and 106.3636 is between the two, which indicates that students have a high level of geometric self-efficacy. Among them, the mean value of the dimension of perceived ability is 53.0364, and the mean value of the dimension of perceived control is 53.3818.

#### 3.2. Correlation analysis between geometry self-efficacy and mathematics achievement

Table 3 Correlation analysis between geometry self-efficacy and mathematics achievement of seventh grade students.

		Geometric self-efficacy	Math score
Geometric Self-efficacy	Pearson correlation	1	.594**
	Significance		.000
	N	55	55
Math score	Pearson correlation	.594**	1
	Significance	.000	
	N	55	55

\*\* . Significantly correlated at the.01 level

As can be seen from the above table, the correlation coefficient between self-efficacy and math performance of Grade 7 students on Day is 0.594, and the significant P value is less than 0.01, indicating that there is a significant positive correlation between them.

#### 3.3. Difference Analysis of Geometric Self-efficacy in Gender

Table 4 Group statistics.

	gender	N	The mean	Standard deviation	Standard error of the mean
Geometric self-efficacy	men	28	109.7500	20.32627	3.84130
	Women	27	102.8519	17.75410	3.41678

Table 5 Independent sample test.

		Levene test of variance equation		T-test of the mean equation						
		F	Sig.	t	df	Sig	Mean difference	Standard error	95% of the difference	
								Letter		Interval
Geometric self-efficacy	Assume equal variances	1.337	.253	1.338	53	.186	6.89815	5.15383	-3.43913	17.23543
	Assumed variance is not equal									
				1.342	52.499	.185	6.89815	5.14101	-3.41571	17.21201

It can be seen from Table 4 that the mean value of geometric self-efficacy of boys and girls is 109.7500 and 102.8519 respectively. As can be seen from Table 5, the homogeneity of variance test is  $0.253 > 0.05$ , and the homogeneity of variance test is not significant, that is, the homogeneity of variance of the two groups. There is a significant difference in geometric self-efficacy between the sexes, and boys' geometric self-efficacy is higher than girls'.

### **3.4. Geometry Learning Self-efficacy Open-ended Questionnaire Results**

After sorting out the 55 valid open-ended questionnaires, it was found that in the answer to the first question, only 12 students said “confident”, “challenging” and “like” in mathematics and geometry, while the other students said “don't like”, “geometry is too difficult” and “won't”. In the answer to the second question, the students' answers focused on such points as “need to make auxiliary lines”, “moving points”, “complicated geometric figures” and “long description of the topic”. Some students described specific knowledge points such as “rotation”. In the answer to the third question, students answered “interest”, “persistence”, “love math” and these characteristics.

### **3.5. Interview Results of Teachers**

According to the interviews with the corresponding teachers, the teachers reflected that the students did not like to write in the process of learning geometry. When encountering some geometric problems, they would choose the attitude of escape and skip directly without thinking. Teachers also reflect that students are not good at summarizing learning knowledge, always feel that they understand is learned, but every once in a while when they encounter the same type of problems, they forget the ideas of solving problems they have learned before.

## **4. Research Conclusions**

Through the geometry test survey, open questionnaire and statistical software data analysis, the following conclusions are obtained.

- (1) The self-efficacy of the mathematics and geometry part of the seventh grade students is relatively high.
- (2) There is a significant correlation between students' geometric self-efficacy and math performance.
- (3) There is no significant difference in gender. Boys' geometric self-efficacy is higher than girls'.
- (4) In mathematics, I am not interested in learning mathematical geometry, and I am afraid of difficulties. I do not have a firm grasp of theorems and concepts, and I am not good at summarizing and internalizing the problem-solving ideas explained by teachers.

## **5. Suggestions for Improving Self-efficacy in Geometry Learning**

- (1) Teachers should create situations to stimulate students' interest in learning geometry.

Interest is the best teacher, without students' interest in learning, teaching is not a very good effect. Therefore, in the teaching process, we should link geometry problems with some vivid and interesting real life. Make full use of the teaching methods of visual object, visual image and visual speech, highlight the characteristics of geometric figures, change the abstract into concrete; Can also be in geometry problem solving and teaching process skillfully set suspense, mobilize the enthusiasm of students. For example, when learning the properties of isosceles triangles, we can ask each student to prepare a template of isosceles triangles and get the properties of isosceles triangles by cutting, measuring and other ways.

- (2) Students should have a deep understanding of concepts and theorems.

Concepts and theorems are the foundation of geometry learning, the basic unit of thinking, and the basis of reasoning and argumentative in plane geometry. It is necessary to have a deep understanding of concepts and theorems, and to be able to use them flexibly in the proof process. If you have a superficial understanding of concepts and theorems, can't grasp their essence, can't fully grasp the conditions, conclusions and scope of application of concepts and theorems, there will be

such or such thinking obstacles in the proof process, which will make mistakes in the process of solving problems. For example, the property of an Angle bisector is that the points on the Angle bisector are equally distant from each side of the Angle. Many students do not understand that the "distance to both sides" refers to the length of the vertical line, which leads to unclear thinking when doing this part of the geometry problem.

(3) Let students experience success. Personal success experience has an important impact on self-efficacy. Therefore, students can be assigned some challenging questions suitable for their characteristics. When students work out the questions, they can experience a strong sense of accomplishment and improve their sense of self-efficacy in geometry learning.

(4) Improve students' learning initiative and enthusiasm, develop the habit of summary and induction. When seeing geometry problems, teachers need to guide students to use both hands and brains. Many geometry problems can not know the ideas and answers at a glance. It is necessary to think while drawing, writing and calculating. At the same time, in view of the teacher's explanation and their own thinking, consciously think and sum up different types of topics common ideas and methods.

(5) Cooperative discussion and divergent thinking. There may be more than one way to solve a problem. Each method involves a different approach to the problem. For this kind of problem, you can use the way of group cooperation, discuss from which Angle can be approached to solve the problem. In the process of discussion, I not only deepened the original problem-solving ideas, but also obtained other methods and cultivated the ability of divergent thinking.

(6) Cultivate a good quality of will. Encounter difficulties, encounter the first sight of the title will not shrink, to have the courage to overcome the difficulties.

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