

Investigation on non-intelligence factors in mathematics learning of grade seven students

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Abstract. Some scholars point out that the growth of students is mainly influenced by intelligence factors and non-intelligence factors, and non-intelligence factors are closely related to intelligence factors. Through the questionnaire survey, the non-intellectual factors of the students' interest, motivation and attitude in mathematics learning were investigated. The results showed that there were significant differences in the level of non-intellectual factors between the low achievers, the high achievers and the potential students. The non-intellectual factors of the high achievers were better than the low achievers. Based on the above research results, specific suggestions and measures are put forward to provide reference for mathematics teaching in primary and secondary schools.

Keywords: junior high school students; Mathematics; Non-intellectual factors.

1. Introduction

After learning from the front-line teachers, it is found that after the removal of the external "assist" of the remedial class, the students' performance has a trend of polarization. In this case, it is very important to guide low achievers to make correct attribution and complete the transformation of low achievers[1]. Psychologists have pointed out that the growth process of students is mainly affected by two factors, intellectual factors and non-intellectual factors[2]. Wechsler's belief that non-intelligence factors are part of intelligence is widely accepted by Western scholars. Kriegbaum[3] pointed out that non-intellectual factors such as learning interest and motivation have a profound influence on the formation of students' mathematical literacy. Lee[4] pointed out that students' level of non-intelligence factors directly affects their classroom performance.

Epstein et al. called it "applied intelligence" and measured this intelligence from six dimensions: emotion control, behavior control, stereotyped thinking, superstitious thinking, internal optimism and negative thinking[5]. In addition, some scholars have designed a special measurement questionnaire for a certain non-intelligence factor, such as the Learning Motivation Strategy Questionnaire compiled by Pintrich et al.[6], they divided learning motivation into six dimensions, including internal motivation, external motivation and self-efficacy. This kind of questionnaire compilation mode has unique ideas and detailed contents, so it is favored by researchers from all over the world[7].

According to the attribution theory of success or failure by American psychologist Weiner, if a student attributes his learning failure to immutable and uncontrollable factors, he will lose his confidence to continue learning. However, if failure is attributed to factors within their control, such as efforts, learning attitude and other non-intellectual factors, it can motivate them to study more seriously[8].

2. Research Design

2.1 Research Objects

Students in grade seven are in the transition stage from primary school to junior middle school. Students in this stage are in the critical period of physical and psychological transformation. Many

students are easily confused about the changes of identity and environment[9].Therefore, it is necessary to deeply investigate the non-intellectual factors of students in this particular period.

In this study, a total of 292 students from 6 classes of a middle school in Heze city were selected as the survey objects through random sampling. Through sorting out and quantitative analysis of the questionnaire data by SPSS19.0.

2.2 Implementation of questionnaire survey and performance survey

The questionnaire selected Likert 5 level scale of "investigation on non-intelligence factors of students' Mathematics Learning" compiled by Li Haiyun of Tianjin Normal University[10], and the reliability and validity of the questionnaire are good. The questionnaire contains 35 questions. In order to guarantee the objectivity of the students answer, three dimensions of the topic to disperse treatment, the interest 10 questions, the motivation 11 questions, the attitude 17 questions. And each question has 5 different answers of "very consistent", "relatively consistent", "uncertain", "not very consistent" and "inconsistent", corresponding to 5, 4, 3, 2, 1 five different points (all positive value), the full score of the questionnaire is 175 points.

To explore non-intelligence factor relations with students in math studying, and further put forward the corresponding suggestions for improvement of mathematics teaching, this study in the junior school the first grade students of a recent achievement for reference, the final examination will score ranking (descending) of 27% and 73% as the cut-off point, students with a score of 105 or above are defined as "high achievers", those with a score of 58 or below are defined as "low achievers", and those with a score between 58 and 105 are defined as "potential students". According to the classification method, 79 low achievers, 79 high achievers and 134 potential students were obtained.

3. Data Analysis

3.1 Total score distribution of non-intelligence factors among grade seven students

Through sorting out the questionnaire data, it was found that the scores of non-intelligence factors of students presented a skewed normal distribution, with an average score of 131.66. Most students scored between 105 and 140, accounting for 55.8% of the total number of respondents. In addition, 36 percent of the students scored at least 140, indicating a high level of non-intelligence.

The above data indicate that the level of non-intelligence factors of grade seven students is above average. Some studies have pointed out that there is no big difference in intelligence factors among students entering the same junior middle school, but their academic performance is very different, which is caused by different levels of non-intelligence factors. Therefore, although students who scored less than 105 only accounted for 8.2 percent of the total number of students surveyed, this phenomenon cannot be ignored.

3.2 Scores of all dimensions of non-intelligence factors of grade seven students

Table 1 Average score rates of all dimensions of non-intelligence factors of grade seven students

	Interest	Motivation	Attitude	Total score
M	35.66	42.25	51.77	131.66
F	50	55	70	175
R	71.32%	76.82%	73.96%	75.23%

Table 1 shows the mean score(M), full score(F) and scoring rate(R) of each dimension respectively. Obviously, the average score rate of all dimensions of non-intelligence factors is more than 70%, among which the average score rate of learning motivation is the highest, which is 76.82%, which indicates that the students who have just entered junior middle school have higher learning motivation in mathematics.

It is worth noting that mathematics learning interest level scored the lowest among the three dimensions. From previous studies, it is not difficult to find the reason why students' interest in mathematics learning is relatively low. The main reason is that mathematics is an abstract subject.

3.3 Difference analysis of non-intelligence factors among students of different grades in grade seven

According to the data in Table 2, it is easy to find that the mean scores of "low achievers(L)", "potential students(P)" and "high achievers(H)" in the three dimensions of non-intelligence factors all show an increasing trend, that is, there are certain differences in non-intelligence factors among students with different academic achievements.

Table 2 Descriptive statistics of each dimension of non-intelligence factors

	Learning Interest			Learning motivation			Mathematics learning attitude		
	L	P	H	L	P	H	L	P	H
N	79	134	79	79	134	79	79	134	79
The mean	31.57	36.53	40.15	39.08	43.53	45.81	46.3	53.09	57.85

In order to further understand and analyze the differences of non-intelligence factors among students with difficulty in learning mathematics, those with normal achievement and those with outstanding achievement in grade seven, this study adopts the method of one-way ANOVA to compare the differences of three dimensions of mathematics learning interest, motivation and attitude under the performance grouping respectively. As shown in Table 3, the results of Levene's homogeneity test of variance show that the difference significance coefficients of the three dimensions are 0.300, 0.074 and 0.276 respectively, which are all greater than 0.05, indicating homogeneity of variance.

Table 3 Test of homogeneity of variance

	Levene statistic	df1	df2	significant
Interest	1.208	2	289	0.300
Motivation	2.626	2	289	0.074
Attitude	1.293	2	289	0.276

Table 4 lists the mean square (MS), F value and SIG value of deviations between groups and within groups of each dimension of non-intelligence factors.

Taking the dimension of mathematics learning interest as an example, sig value is 0.000, that is, $P < 0.001$, which indicates that under the level of mathematics learning interest, each score group has significant difference at 0.001 significance level. The results are the same for motivation and attitude level, that is, there are significant differences among the scores under the three dimensions of non-intelligence factor.

Table 4 Analysis of Variance

	Interest		Motivation		Attitude	
	Between groups	Within the group	Between groups	Within the group	Between groups	Within the group
MS	1543.163	30.714	971.335	37.86	2732.455	51.743
F	50.242		25.656		52.809	
SIG	0.000		0.000		0.000	

To sum up, there are significant differences in the level of non-intellectual factors among students with different grades in grade seven, and the higher the score is, the higher the level of non-intellectual factors is. Generally speaking, if students have high levels of one of these non-intelligence factors, they have similar levels of the other two.

4. Conclusions and Suggestions

4.1 Conclusions

There is also a significant difference in the level of non-intelligence factors among students with different academic performance. The interest, motivation and attitude of mathematics learning of high achievers are generally higher than those of low achievers. To be specific, half of the students' interest in mathematics comes from the love of mathematics itself, which will not be easily changed, while the students with difficulty in learning mathematics are often affected by external factors, and they may reduce their interest in mathematics just because they do not get good scores. This can also explain the difference between high achievers and low achievers in mathematics learning motivation. Learning interest and motivation will directly affect the students' learning attitude, thus resulting in the learning attitude difference between low achievers and high achievers.

4.2 Suggestions

First of all, it is necessary to fundamentally change students' stereotype of mathematics and cultivate their interest in mathematics. Introducing mathematical culture, combining knowledge with reality, situation teaching and other measures can be used to attract students' attention and cultivate their interest in mathematics.

At the same time, teachers can try to combine stratified teaching with individual guidance to enhance students' successful experience. Ausubel's learning motivation theory points out that motivation and learning complement each other. After experiencing success, people will have greater motivation to continue to move towards new goals. In teaching, teachers should adhere to the principle of teaching students in accordance with their aptitude, assign different tasks to students at different levels, so that all students can experience the happiness of success, and then carry out targeted after-class tutoring according to the characteristics of students[11].

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