

Analysis of Multiple Intelligences of Gifted Children in Mathematics

Ryu, Sung Rim

Department of Mathematics Education, Daegu National University of Education,
1797-6 Daemyung-2-Dong, Nam-gu, Daegu 705-715, Korea; E-mail: srryu@dnue.ac.kr

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The purpose of this study is to analyze the strength and weakness of the intelligences appeared by the profile of the multiple intelligences of gifted children in mathematics. The subjects of this study were 80 students from D-Education Center for Gifted Children in Korea.

Their multiple intelligences were measured by the self-scaling test of Korean-Multiple Intelligence Development Assessment Scale, in July 2006.

The conclusions of this study are as follows:

First, the strengths of multiple intelligences of the gifted children in mathematics are in logical-mathematical intelligence, intrapersonal intelligence and interpersonal intelligence. And, the weakness of multiple intelligences of the gifted in elementary mathematics is in bodily-kinesthetic intelligence. Second, formal educational curriculum of the gifted in elementary mathematics is required which can stimulate all kinds of intelligences.

Keywords: gifted children, multiple intelligence.

ZDM Classification: C42

MSC2000 Classification: 97C99

I. INTRODUCTION

The starting point of gifted child education is to pick out potentially gifted children. Although good educational institutes and educational programs are established, educational effects are bound to be lowered unless true gifted children are selected. Until now, giftedness has been explained by the classical concept of general intelligence, and it has been believed that general intelligence can be measured by intelligence quotient (IQ) test. Recently, however, a paradigm shift has been happening that giftedness can be explained by the concepts of multiple intelligences better than by the concept of general

intelligence. The concepts of multiple intelligences explain that since human beings' intelligence exists independently in various fields, they can be tested in a various ways, not only by IQ but also by problem solving or task performing abilities. It is reported that gifted children generally have high level of IQ (more than 130); however, this result is based on a single intelligence test (focused on linguistic, logic-mathematical field).

Using the Gardner's multiple intelligences theory, which measures intellectual domains (that is, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalist intelligences) not included in general intelligence tests, can help gifted children to reveal their strong and weak types in various intelligences, particularly helping maximize the effectiveness of selected students' learning by considering their distinctive quality (Gardner, 1983, 1993; Nelson, 1997).

This study intends to analyze multiple intelligences of the elementary school students who has been selected as gifted children in mathematics and are now taking classes, examines the strength and weakness in their intellectual abilities, and identifies what relationships exist between multiple intelligences and their desiring occupations in the future.

II. GIFTED CHILDREN IN MATHEMATICS AND MULTIPLE INTELLIGENCES THEORY

1. Concept of Gifted Children in Mathematics

Generally, gifted children have higher abilities in intelligence, task commitment, and creativity than average students, and show already good achievements or have the possibility to do so in one or more fields of the following:

- ① general intelligence;
- ② special scholastic aptitude (linguistic, mathematical, scientific, social features, etc);
- ③ creative or productive thinking;
- ④ leadership;
- ⑤ visual performance arts; and
- ⑥ bodily-kinesthetic intelligence.

Mathematical geniuses are those who have already achieved good results or are expected to do so in mathematics and who require special educational programs and services that go beyond formal schooling. More specifically, they have more than average abilities in mathematical thinking, task commitment, creativity, and background knowledge factors.

2. Theory of Multiple Intelligences

A distinguishing characteristic in recent studies of intelligence is a tendency to escape from the narrow concept of intelligence as scholastic performance and understand it broadly as a mental ability exerted in a situation where an individual get faced. A representative theory reflecting and taking the lead in this recent trend is the theory of multiple intelligence proposed by Gardner (1993, p. 15) defines intelligence as “the ability to solve problems in a given cultural situation or community and form important outcomes.”

According to Gardner (1983), every person has eight unique intelligences, relatively autonomous so that they are independent with each other. Thus, high intelligence in one field does not necessarily mean high intelligence in other fields. However, these eight intellectual domains are characteristic of solving problems and performing creative activities independently, while they combine to influence each other’s development. He believes that environmental settings in childhood - that is, training - can facilitate intellectual development.

- (1) Linguistic intelligence: Found in literary men or journalists, it means the ability to make use of a language, understand its nuance, sequence, rhythm, and meaning, and express their opinion.
- (2) Musical intelligence: Found in musicians such as composer, performing musician, singer, director, it means the ability to express their feelings well in a musical way and very sensitively respond with and express various traits of sound such as pitch, rhythm, melody and tune.
- (3) Logical-mathematical intelligence: Found in geniuses like Einstein in fields of mathematics, science, and logics, it relates to logical and mathematical talents.
- (4) Bodily-kinesthetic intelligence: Found in sportsmen, dancing masters or magicians, it is associated with the ability to recognize and understand external stimuli, information and problems through their body, control completely their bodily movements, and handle objects skillfully.
- (5) Spatial intelligence: Found in architects, engineers, sculptors, and artists, it means the ability to change or develop a phenomenon or a thing in a visual-spatial way of expression.
- (6) Interpersonal intelligence: Found in counselors, salespeople, or religious men or philosophers such as Buddha, Gandhi and Socrates, it is similar to social intelligence.
- (7) Intrapersonal intelligence: Found in those who are well aware of and control their feelings, those who well maintain their physical conditions and behaviors, or religious men, it means the ability to identify and understand objectively and

deeply their true color such as, impressions, merits and demerits, specialties, desires, concerns.

- (8) Naturalist intelligence: It means the ability to classify and recognize various kinds of plants, minerals, and animals, such as flowers, grasses, and stones.

Gardner asserts that since measurement of multiple intelligences by a written examination is incomplete, it should be made by observing various activities conducted in the living context; however, because of its conveniences many scholars are using a written examination designed to measure multiple intelligences. For example, Shearer (1995; 2004) developed and used the *Multiple Intelligence Development Assessment Scales* (MIDAS) for elementary students, which is a self-scaling test that students answer questions of everyday life, requiring their cognitive power, involvement, and judgment

III. RESEARCH METHODOLOGY

1. Subject of Study

The subjects of this study are eighty gifted children in mathematics who are now enrolled in D Gifted Education Center (forty each in the 5th and 6th year grade).

2. Measuring Tool and Procedure

This study employs a written examination that the Seoul National University Education Research Institute (1996) developed for the upper-grade students in elementary school on the basis of MIDAS developed by Shearer (1995) for elementary students. The MIDAS used in this study consists of a total of seventy questions in seven fields, with ten questions in each field. The test for this study was conducted for about thirty minutes in July, 2006.

The following is an example of question items in logical-mathematical intelligence:

Question 21. I am more interested in mathematics instruction than others.

_____ ① Absolutely yes. _____ ② Somewhat yes. _____ ③ No.

3. Data Processing and Analysis

Collected data is graded, encoded, and analyzed using percentile scores by factors and occupations desired in the future. The scoring method is as follows: in each question, three points is allotted to the choice of 'Absolutely yes,' two points to 'Somewhat yes,' and one point to 'No.' A total score in a factor is obtained by summing up scores of each

question.

IV. ANALYSIS OF RESULTS

1. Strength and Weakness in Mathematical Geniuses' Multiple Intelligences

To identify the strength and weakness in mathematical geniuses' multiple intelligences, the arithmetical mean and standard deviation of seven intelligence areas are calculated. The former is relatively high, 76.80, and the latter is 6.08. Thus, the multiple intelligences on the strong side is calculated as 82.88 ($76.80 + 6.08$), and the multiple intelligences in the other side is calculated as 70.72 ($76.80 - 6.08$). As shown in Figure 1, the logic-mathematical intelligence perfectly belongs to the strong side; in addition, intrapersonal and interpersonal intelligences are classified as strong points, because they are close to the strong side.

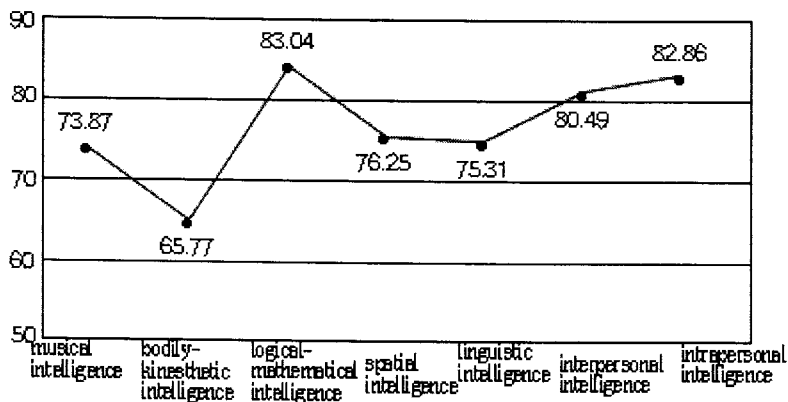


Figure 1. Profiles of mathematical geniuses' multiple intelligences

Next, Table 1 shows the arithmetic mean and standard deviation of all the gifted children's multiple intelligences and the strength and weakness.

As shown in Table 1, gifted children have relatively strength in logic-mathematical, interpersonal and intrapersonal intelligences, while weakness in bodily-kinesthetic intelligence. Besides, their linguistic, spatial and musical intelligences belong to a mid level.

Notably, they prefer 'solving puzzles' in field of logic-mathematical intelligence, while comparatively disliking 'collecting interesting things' (stamps, coins, etc.). In case of intrapersonal intelligence, the question of 'defining one's liking or disliking' gets the highest points. In case of interpersonal intelligence, responses to most questions get high points, except that the question of 'getting well with unacceptable friends' gets a little

negative responses. In spatial intelligence, the most favorite activity is ‘arranging blocks,’ ‘fixing activity’ gets the lowest score. Particularly, in case of bodily-kinesthetic intelligence, they dislike ‘mimicking a friend or entertainer’ and ‘dancing’ activities. Comparing Ryu (2004), logic-mathematical intelligence replaces the rank of intrapersonal intelligence, and the remaining results are similar (*cf.* Kim & Ryu, 2007)

Table 1. Mean and standard deviation of all the children’s multiple intelligences

Multiple intelligences	Mean	Standard deviation	Rank	Strength/weakness
musical intelligence	73.87	7.52	6	mid
bodily-kinesthetic intelligence	65.77	12.66	7	weak
logical-mathematical intelligence	83.04	9.07	1	strong
spatial intelligence	76.25	9.69	4	mid
linguistic intelligence	75.31	10.41	5	mid
interpersonal intelligence	80.49	7.68	3	strong
intrapersonal intelligence	82.86	8.34	2	strong
Total	76.80	6.08		

2. Analysis of Multiple Intelligences by Future Occupations Desired

The occupations that gifted children in mathematics desire to have in the future are shown in the following Figure 2 and Table 2.

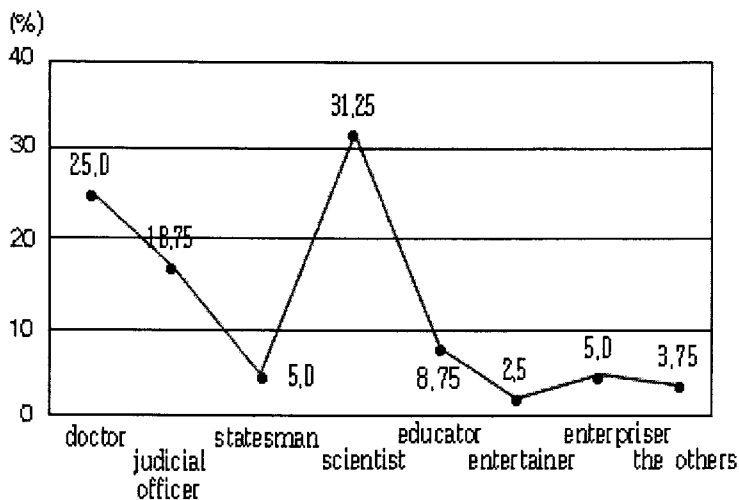


Figure 2. Profiles of future occupations desired

Table 2. Future occupations desired

Occupation	5th grade (%)	6th grade (%)	Total(%)
doctor	6 (15.0)	14 (35.0)	20 (25.0)
judicial officer	10 (25.0)	5 (12.5)	15 (18.75)
statesman	1 (2.5)	3 (7.5)	4 (5.0)
scientist	15 (37.5)	10 (25.0)	25 (31.25)
educator	3 (7.5)	4 (10.0)	7 (8.75)
entertainer	1 (2.5)	1 (2.5)	2 (2.5)
enterpriser	2 (5.0)	2 (5.0)	4 (5.0)
the others	2 (5.0)	1 (2.5)	3 (3.75)
Total	40	40	80

As shown in Figure 2 and Table 2, the most favorite job is a scientist (31.25%); the next is doctors (25.0%); and judicial officers take the third place (18.75%). Many of them prefer scientists and doctors. Particularly, the 5th grade students prefer scientists (37.5%), judicial officers (25.0%), and doctors (15.0%), while the 6th grade students prefer doctors (35.0%), scientists (25.0%), and judicial officers (12.5%), indicating that as they are in a higher class, they seem to be affected by job preferences in current society. And Figure 3 and Table 3 show multiple intelligences of the students who desire to become a scientist or doctor, a job that the most students prefer.

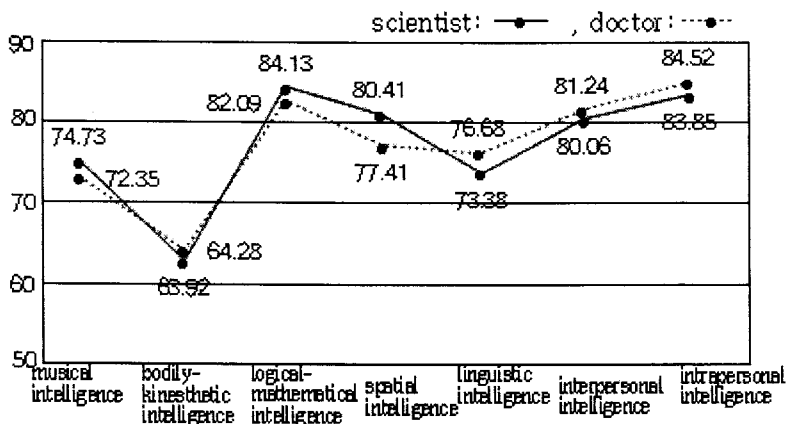


Figure 3. Profiles of mathematical geniuses' multiple intelligences by job category

Figure 3 and Table 3 show that the students hoping for scientists have high logic-mathematical and intrapersonal intelligences, and a little high spatial and interpersonal

intelligence, but they have low bodily-kinesthetic intelligence.

Table 3. Multiple intelligences by job category

Multiple intelligences	Occupation	Scientist		Doctor	
		Mean	Rank	Mean	Rank
musical intelligence		74.73	5	72.35	6
bodily-kinesthetic intelligence		63.92	7	64.28	7
logical-mathematical intelligence		84.13	1	82.09	2
spatial intelligence		80.41	3	77.41	4
linguistic intelligence		73.38	6	76.68	5
interpersonal intelligence		80.06	4	81.24	3
intrapersonal intelligence		83.85	2	84.52	1
Total		77.21		76.94	

The students hoping for doctors tend to have high intrapersonal, logic-mathematical and interpersonal intelligences and relatively high spatial and linguistic intelligences, but they tend to have low bodily-kinesthetic intelligence. However, those who desire to become a surgeon should have high bodily-kinesthetic intelligence, meaning that some measures are necessary. Although it does not cover multiple intelligences for all the jobs desired, this study reveals that hoped-for scientists have a little higher logic-mathematical intelligence than hoped-for doctors, and hoped-for doctors have a little high interpersonal, logic-mathematical and intrapersonal intelligences, compared to other intelligences.

V. CONCLUSION

This study measured and analyzed multiple intelligences of the mathematical geniuses in an elementary school, according to Gardner's multiple intelligences theory. Overall, they showed strength in logic-mathematical, intrapersonal and interpersonal intelligences, but weakness in bodily-kinesthetic intelligence. In job preference, they preferred scientists, doctors and judicial officers in this order; hoped-for scientists had high logic-mathematical and intrapersonal intelligences, and also their spatial and interpersonal intelligences are a little high. The students who hoped for doctors had high interpersonal, logic-mathematical and intrapersonal intelligences. Judging from the fact that gifted children generally have high interpersonal and intrapersonal intelligences, we can say that they have strong leadership, make much self-examination, and lead a planned life. Considering many students prefer jobs out of mathematical field such as doctors and judicial officers, we need not only to operate programs related to logic-mathematical

intelligence, but also to develop programs connected with other intellectual fields.

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