

How Gifted Chinese Students Study Mathematics

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Based on interview and observation, this study explored gifted students and their mathematics learning. The results showed that (1) balancing learning and leisure as a healthy life, (2) emphasizing on acquiring and obtaining thinking method of mathematics, (3) adapting themselves towards a positive learning circle, and (4) creating a smooth communication among classmates seemed to be important characteristics for gifted students. The study suggested that regular students could make the effort to use such approaches that have brought gifted students in successful learning.

Key words: teaching and learning, gifted education.

Research Background

The methods and style of learning mathematics may vary among Chinese students regionally. In Mainland China, over 10 million students graduate from high school in recent years. The policy for those high school graduate students to enter different levels of universities makes difference for students' lives. Although new released 1-12 mathematics standards as well as curricula seem to have great impact on student learning mathematics, is also brought the arguments on gifted student learning mathematics. To define the term of gifted, some Chinese people consider students who can achieve all high scores among all disciplines as gifted students. There are two kinds of gifted students: one is the students who can earn Number One Scholar title in their local cities or provinces, and another one is students who can earn the champions such as Olympic mathematics competition in national learning leagues. The privilege for such gifted students is that they have much more opportunities to study in the top universities (Wang, 2005).

The purpose of this article is to explore (a) how these gifted students learning mathematics different from regular students and (b) what are the characteristics of these gifted students might have in learning mathematics.

Data Collection, Analyzing, and Discussion

Learning for Understanding

Although both gifted and regular students spend the considerable time on mathematics learning, their time management is different. According to Wang (2005), the time distribution of gifted students is different from that of regular students. Table 1 shows such difference: the gifted student reflected by the table was one of the top universities while regular students were enrolled by one of the local universities in Jiangxi Province.

Table 1

Daily Learning Schedule of Gifted and Regular Students (unit: minute)

Activities	The time of 40 minutes on class			The time out of class			Time in sum
	Remembering instruction	Understanding	Class exercises	Preview/review	Finishing assignment	Autonomic exercise	
Gifted students	15~25	20~30	8~10	25~30	15~20	25~35	105~125
Regular students	30~35	5~10	10~15	10~15	30~35	30~40	110~130

Analysis

From table one, the gifted student spent more time on preview and focused on important ideas that will be taught in next day while regular students always rely more on teacher's instruction. Therefore, gifted students emphasize on preview. Though gifted students, on some occasion, spend much more time in learning than the gifted students, but their time allocation is quite different from gifted students. Paying more attention to self-reflecting and active learning, gifted students allocates twice the time of regular students pay for preview, review, and understanding. In contrast, regular students take averagely about twice the time of gifted students distributes to remembering instructing knowledge and class exercise, and a number of gifted students' time was given to complimentary understanding to class knowledge. Following gifted student's expression might help us further understand the why. "There is no general technique or method for learning, but emphasizing on thinking and understanding."

Teachers' Reflection on Gifted Student Learning

One teacher summarized the gifted student learning in classroom that "gifted students' paying attention to in-class learning and exercise, they generally picked up as their typical mathematics learning style, and planning, monitoring, adjusting and recollecting to learn on their own behaviors. They summed up as a general learning style for all disciplines' learning by a number of teachers." As one teacher indicated that "besides, paying attentions to teachers' teaching in classes, gifted students always express their ideas and participate in discussion actively. For many of them, with a high learning efficiency, they acquire the new knowledge in classes. And, they value

the importance of class exercises.”

Gifted Students’ Reflection on their own Learning

Gifted students have their own learning style in general as one student indicated that “It is obvious that the difference of leaning time between mine and general mates is not in the amount, but in the organization. Scheduled on my own, my daily learning plan is quite suitable. And the planning may be helpful to be aware of the tempo and followings steps for me as well. And the spared leisure and amusement, makes the accentuation of my plan convertible from the amount into persistence.” Another student has a similar thought by saying that “Learning demands individual planning. In the long run, a weekly planning for certain knowledge is necessary, and in the short run, a daily planning for each discipline at certain time is essential. Learning subjects to learner’s regulating. When you are of good sense, some difficult subjects in science disciplines are optional, and when you are tired, some leisure, easy and direct subjects may be suitable.”

An Example of Gifted Student Learning in the Classroom

Following is an example of classroom teaching involving gifted student learning trigonometry.

Teacher: Since we have learned various common proof techniques for inequality, and we have learned logarithm in last term, let us have a look at how to proof the following logarithm: $\log_2 3 > \log_3 4$.

(The teacher asked students to demonstrate the logarithm concept, and one gifted student raised her hand and came to front to demonstrate such concept to whole class.)

Gifted student: $\frac{\log_3 4}{\log_2 3} = \log_3 4 \log_3 2$,

$$\because \log_3 4 > 0, \log_3 2 > 0, \quad \therefore \log_3 4 \log_3 2 < \left(\frac{\log_3 4 + \log_3 2}{2}\right)^2 = \left(\frac{\log_3 8}{2}\right)^2,$$

$$\because \log_3 8 < \log_3 9 = 2, \quad \therefore \left(\frac{\log_3 8}{2}\right)^2 < \left(\frac{2}{2}\right)^2 = 1,$$

$$\therefore \frac{\log_3 4}{\log_2 3} < 1, \text{ also } \log_2 3 > 0,$$

$$\therefore \log_3 4 < \log_2 3, \log_2 3 > \log_3 4.$$

Teacher: Well done, what about next one? $\log_4 5 > \log_5 6$.

(This time, more students raised their hands. Teacher asked class to proof it in their seats. The gifted student proved the result rapidly and raised the question if the logarithm $\log_n(n+1) > \log_{n+1}(n+2)$ could be true.)

Teacher: Let us prove its reliability! And the conditions of inequality should be reckoned

This case indicated the gifted students are not satisfied with certain level of knowledge and they always actively expand their thinking for the maximum capacity

to the subject. Interviewing the teacher also confirmed the above statement about the gifted students. According to the teacher “instead of indulged in solving subjects, to get something beyond it, gifted students may monitor the solving process and adjust themselves accordingly. As the subject is solved, they are apt to remember and extract mathematics ideas from it. And they regard this as an effective method to enhancing thinking. Also, they may attempt further work for some new conclusion and subjects related to the concluded one. They may seek for specific value of every subject by learning change.”

Characteristics of Gifted Students’ Learning

From the above examples, we summarized four characteristics of gifted students’ learning: (a) balancing learning and leisure as a healthy life, (b) emphasizing on acquiring and obtaining thinking method of mathematics, (c) adapting themselves towards a positive learning circle, and (d) creating a smooth communication among classmates.

Balancing learning and leisure as a healthy life

Three gifted students with the honor of Number One Scholars were interviewed. And their comments on preparing for college entrance examinations may reflect the importance of mediating learning and leisure.

Avoid repeating technically is crucial to learning. To relieve strained tension, some suitable music may be helpful. For instance, if you need enthusiastic and energy, Ludwig van Beethoven’s symphonies, for instance Symphonies No.5; and if you need a leisure to escape from tiredness, Schubert’ serenade may be helpful. In one word, balancing working and relaxing according to you is decisive to brainwork.

Being diligent has nothing to do with learning and working. Apart from learning, there are many experiences and enjoyable activities waiting for us life. So, we are not supposed to be fully occupied by learning, but to be moved and educated by the life out of textbooks, we can have a splendid life.

For each morning I always have a jog around playground with some friends, to enjoy the fresh air in the morning. Immediately after I had lunch, I would head into playing basketball with my classmates. And every evening, reading books and listening music are my hobbies before go to bed at 10:30.

From above comments, gifted students always take enough sleeping as an important sector to learning. Bearing in mind that working till midnight can neither result in a high efficiency nor an active learner for the next day; they seldom go to bed very late. What is more is that they never exhausted themselves in learning. With a rational idea that, learning is of acquiring knowledge efficiently and economically, but not of learning longer and training with subjects as much as possible, even when they are tired, compared with regular students’ continuing to tedious learning, taking a nap and taking a exercise are their customs. Therefore, gifted students get a win-win situation between the amount of learning time and learning objects are their pursuing

target in their learning activities.

Emphasizing on acquiring and obtaining thinking method of mathematics

Apart from balancing learning and leisure during the preparation for college entrance examination, a champion in a national mathematics league gave us a distinctive and illuminative word to mathematics learning that are more pertinent to get an even more gifted achievement in mathematics learning. And a Number One Scholar's experience of preparing for national college entrance examination may explicate it as well.

For solving subject demands students to understand and comprehend the concepts and formulas, the understanding and remembering of the basic concepts and formulas in textbook may be crucial. The importance of solving subjects lies not in the amount but the quality. Therefore, classifying subjects and grasping their solving methods by illuminating from each subject, are much more important than solving numberless subjects.

Mathematics learning is especially important to the students of arts and social science. Half of my mathematics courses had been learned when I was a Grade three student. Mathematics learners are supposed to be aware of specific methods and mathematics thoughts. Some general solving methods, such as the method of specific value and inferring from a single instance, are supposed to be acquired. And among mathematics thoughts, the symbolic-graphic combination, which can simplify thinking process, is a widely used. For instance, having a geometrical understanding to complex may enhance the efficiency and effectiveness of solving. Also, the good understanding of the relationship among equation, image, image of function and the expressions of function, may not only be positive to the solving of subject, but also be helpful to its examination. In sum, mathematics thoughts are positive to acquiring a learning drive in students.

In contrast with learning without understanding or inquiring, gifted students, especially champions in various learning league, always take the acquiring and grasping to mathematics thoughts and methodology as an important part of the learning of it. During mathematics subjects solving processes, the acquiring and applying of mathematics thoughts and method always play an important role. And to a larger extent, this learning style is why a champion could get victory as well as ensure learning other disciplines.

Adapting themselves towards a positive learning circle

In various interviews with gifted students, the researchers and teachers found that the so called gifted students were a generative process. Though some of them have a positive learning custom, but a number of interviewees mentioned their conversion from a difficulty in learning into an apparently positive learning custom. To some extent, this conversion may be more illuminative and impressive than the students who have had a positive learning custom for a long time.

I got a full mark, 150, in the mathematics test of college entrance examination. But,

to be honest, in contrast to other disciplines, I confronted a serious difficulty with mathematics; I used to be bottom in my class in mathematics learning in my first year in high school. After a period of nervousness and anxiety, I determine to learn from the pioneers in mathematics, but not forgive myself to the reality. Prevailed against multiple worries, I began to take a remediation in math. By paying attention to instructions, reviewing promptly, apperceiving subject and summarizing representative problems, both my score and learning interest showed a positive situation gradually. In a long run, apart from teacher's assignment, I began to find and analyze some additional subjects. And a win-win situation was got between the foundation and capability.

Gifted students always have a set of personalized methods to previewing, learning their lessons and reviewing. At the previewing stage, they always study intensively and mark various difficulties before taking class. When they have lessons, besides concentrated on teachers' instruction, they summarized, classified and generalized mathematics ideas and methods. In their spare time, they found and attempted to some extra-curriculum subjects. Thus, they always adapt themselves to the learning background towards an excellent balancing between acquiring knowledge and cultivating capability.

Creating a smooth communication among classmates

It is an interesting phenomenon that gifted students always graduated from some famous and important high schools. Despite their classmates were not so called gifted students in the present research, still always being enrolled by comparatively famous universities and colleges and they were also taken as gifted students by people in daily life. Consequently, researchers were interested in how these two kinds of "gifted students" communicate and get along with each other in an important high school, on such a tough competitive background. Gifted students' speech may give us an illumination to the relationship among diligent students.

The pleasant feeling is from having a smooth human relationship. And a smooth relationship could help me to get a moderate social identification. Consequently, I will become optimistic, active and self-confident in life and learning.

Alike to there is no identical leaves or hands, instead of evaluating and demanding others according individual fond and value, people should adapt themselves to the diversity of the world and accept the differences among people.

Gifted students are neither being indulged to various trifles, nor being distracted in complicated human relation. Oppositely, they are apt to communicate and interact with others. When they were sharing some small group learning tasks, they always participate in a positive way, and some of them may act as leaders in their group. To this extent, gifted students get well with their classmates is not just a general condition but a specific promotion to their learning. Therefore, as long as the classroom is a positive learning atmosphere, giving a collaborative learning setting is supposed to be both helpful to common students and positive to gifted students with more potential as well.

Conclusion

The features of gifted Chinese students' mathematics learning may be outlined as following: (a) Allocating specific time for mathematics learning, attaching due importance to the understanding and appreciating of mathematics, being keen on mathematics problems, and valuing independent thinking of mathematics problems. (b) Pay extra attention to instructions, thinking actively, answering questions enthusiastically and participating in class discussion. Instead of remembering teachers' instruction, gifted students always bring their difficulties to class to communicate with the teachers. (c) Never satisfy with solving certain mathematics subjects, but concentrate on the train of thought and solving methodology. Being accustomed to find the optimal solving and always produce unique and personal solutions. (d) Have the custom of previewing, planning, adjusting and remembering. Gifted students always have the custom of previewing and noting their difficulties before classes and take their questions and critical thinking to class. Gifted students usually review with a recollection trend and motivation and they always solve subjects with a manner of selectivity and re-collectivity. (e) Handling human relationships smoothly and balancing between working and leisure to improve their concentration in learning mathematics.

On the other hand, there are various drawbacks among gifted students, such as improper learning motivation, the shortage of sensibility to problems, and the deficiency of inquiring learning in their learning. These difficulties, to some extent, have led to a number of gifted students having neither the desire to enter various institutes famous for mathematics nor the sense of researching activities about mathematics.

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