Journal of the Korea Society of Mathematical Education Series D:
Research in Mathematical Education
Vol. 9, No. 4, December 2005, 335–340

韓國數學敎育學會誌 시리즈 D:
<數學敎育硏究>
제 9 권 제 4 호 2005 년 12 월, 335–340

The Problems and Enlightenment about Gifted Children's Mathematics Educational Practice in China[1]

Pang, Kun
Southwest Univ., 2 Tiansheng St., Beibei, Chongqing 400715, China;
Chinese People's Armed Police Forces Academy, Langfang, Hebei 065000, China;
E-mail: wj_pk@sina.com

Li, Mingzhen
Southwest Univ., 2 Tiansheng St., Beibei, Chongqing 400715, China;
E-mail: lmz110@sohu.com

(Received September 24, 2005)

According to the mathematics educational practice and research about gifted children in some secondary schools in China, the paper presented some relevant problems:

1. Missing or mistaken selecting in gifted children in China. It included the limitations of identifying standard and the fault of understanding and doing in practice, administration disturbance and emotional inclination.
2. Backward traditional mathematics teaching in gifted children in China. It included lower teaching starting point, slower teaching planned speed, simpler teaching contents and so on.

The paper analyzed the problems, and made enlightenment for gifted children's mathematical teaching strategies: raising starting point of contents; emphasizing essential principles and skills; using flexible teaching methods; encouraging discover and creativity and developing harmoniously psychological level and mathematical ability. As to these strategies, some detail measures were offered as well.

Keywords: gifted children, practice, problem, enlightenment, strategy
ZDM Classification: C40, D40
MSC2000 Classification: 97C90, 97D40

[1] This paper has been presented at Poster Session of the Tenth International Seminar of Mathematics Education on Creativity Development at Korea Advanced Institute of Science and Technology, Daejeon, Korea, October 8, 2005.

BACKGROUND

Modern science research indicates that because of the difference between congenital quality and postnatal education, there is objective difference of intelligence level (Tanenbaum 1983). About 1 to 3 percent children's intelligence develops exceedingly. They have a facile imagination and a photographic memory. They are well known as gifted children.

Gifted children need superior education (Bricsson 2002). In primary and secondary school, mathematics curriculum is one important basic course to develop thinking, exploit intelligence and foster good personality trait. But traditional mathematics teaching pattern does not benefit gifted children's mathematics learning, more badly, it turns into obstruction to develop their potential ability.

According to the mathematics educational practice and research about gifted children in some secondary schools in China such as the Beijing eighths secondary school, the Attached Secondary School to Hunan Normal University and Tianjin Yaoha Secondary School (Tao 1994), the paper will present and analyze some relevant problems, and also offer enlightenment for practice of gifted children's mathematics education.

PROBLEMS

In the course of identifying and selecting gifted children, there are some non-science idea and practice which lead to missing or mistaken selecting.

1. The limitations of identifying standard and the fault of understanding and doing in practice.
2. Administration disturbance. Such as often selecting gifted children with only the course examination. Gifted children's creativity and social acceptability are often thought fully.
3. Emotional inclination.

   (1) The proportion difference between male and female is significant and the number of male is more than that of female. Some schools such as Tianjin Yaoha secondary school have only 30 percent female of gifted students.

   (2) The proportion difference between urban and rural is significant and the number of gifted children who lived in city is more than that of gifted children who lived in country.

   (3) Most of disturbed gifted children are often neglected (Yao 1995), and their

talent are stifled.

As one of basic teaching factors, cognitive starting point includes knowledge starting point and thought starting point. The former is about what and where to teach, and the latter is about how to teach. Because abstract thinking ability of gifted children is much higher than that of ordinary children at the same age (Davidson & Sternberg 1984), traditional mathematics teaching starting point has not benefit gifted children's learning requirement.

The internal connection of knowledge and process of cognition decides that learning is to follow in order and advance step by step (Xu 1995). In mathematics education, gifted children's learning can not leap over any cognitive stage such as sensations, understanding, maintain and applying (Tao 1994). But their acceptable ability is better than ordinary children's (Zhang 2004). In mathematical teaching in gifted children, some mathematics teachers can not often know well the relationship between learning step by step and teaching planned speed quickly.

Creativity is the most important ability that decides if men can live well and achieve good goal. Some research shows that there isn't significant correlation between higher intelligence and superior academic achievement (Hettinger, Kipp & Goldman 2003; Bjorklound & Kipp 2002). So creativity need be fostered specially (Shore 2000). But some mathematics teacher's only pay close attention to teach knowledge in textbook, not notice and develop gifted children's creativity.

ENLIGHTENMENT

In order to achieve higher quality of the research and education of gifted children, science principle, means contents and form of identifying and selecting gifted children should be laid down. The research and education of gifted children should embody educational democracy principle, so every gifted child has equal opportunity in education Equality between male and female, Hans and ethnic minorities, urban and rural in gifted children's education should come true.

To bring into play abstract thinking ability of gifted children, stir up their motivation and attitude in mathematics, it is indispensable that teaching starting point should be improved.

1. Choosing good teaching material. In secondary school, those teaching material can benefit gifted children to master mathematics idea and methods, deepen and develop mathematical essential knowledge.
2. Infiltrating mathematics idea and learning some theatrical knowledge as soon as early. In grade one, transferring thought and simplification idea, simple set and

logic theory should be taught, so thinking ability of the gifted children about mathematics concepts and theorems can be much raised.

Gifted children's smart lies in higher their understanding, solving and aspiration level, not breaking through the principles what are observed by ordinary children in cognition (Robinson 2000). Gifted children learning can not stride across any cognitive stage, but they can quicken their cognitive speed (Kranzler, Whang & Jensen 1994). So mathematical teaching of gifted children is to not only follow in order and advance step by step, but also plan speed quickly. That is, according to gifted children need, teaching must extend contents, enhance depth, quicken speed and improve efficiency. For some more talent children, much more difficult material should be offered. In the Beijin Eighth Secondary School, the comparison of Mathematics teaching contents and total class hours between gifted students and ordinary students is as follows (see Table 1).

Table 1. Comparison of Mathematics teaching contents and total class hours

	Ordinary student	Gifted student
Tteaching contents	Curriculums of Grade 5 to 12	Curriculums of Grade 1 to12; Simple polynomial and determinant; Vector geometry.
Total class hours	1480	882

Teaching knowledge is important (Sternberg, Grigorenko & Ferrari 2002), and developing creativity is essential as well. Creativity is the most important factor that decides gifted children's achievement. When gifted children are in new problem situation their understanding of problem-solving is core part that decides their intelligence (Davidson & Sternberg 1984). So in mathematics educational practice, problem-centred courses should be set up. While teaching knowledge, teacher should teach how to learn, how to think, how to explore and how to solve creatively (Zhu & Simon 1987). Through the teaching pattern of 'asking, thinking, doing and devaluing', gifted children creativity is developed fully.

Table 2. Comparison of creativity

	Creativity (20 points)	*P*
Gifted students (Beijing Eighth Secondary School)	16.9	< 0.01
Ordinary students (Attached Secondary School to Capital Normal University)	13.5	

Asking means problem sets, and thinking means procedural consideration, and doing is process-centered exercise, and devaluing is process assessment. In the Beijing Eighth Secondary School and the Attached Secondary School to Capital Normal University, the comparison of creativity between gifted students and ordinary students is as follows (see Table 2).

According to the teaching practice and research, gifted children's effective mathematical teaching strategies and measures are offered (see Table 3).

Table 3. Gifted children's mathematical teaching strategies and measure

mathematical teaching strategies	measures
raising starting point of contents	◦ gaining theatrical knowledge ◦ infiltrating mathematics idea as soon as early ◦ enhancing connection with other subjects
emphasizing essential principles and skills	◦ understanding mathematics structure and form ◦ applying principle in problem- solving
using flexible teaching methods	◦ combining acceptable learning with discovery learning ◦ distinctive teaching ◦ quick speed with following in order
encouraging discover and creativity	◦ setting up problem situation with enough challenges ◦ encouraging finding and posing problem ◦ encouraging solving problem in many ways ◦ establishing ecological environment of education that benefiting creativity development ◦ organizing outside research group, launching special topic study and learning each other
Developing harmoniously Psychological level and Mathematical ability	◦ improving mathematical oral and written ability. ◦ stressing operated exercise ◦ fostering non- cognitive factors.

REFERENCES

Bjorklound, D. F. & Kipp, K. (2002): Social cognition, inhibition, and theory of mind: The evolution of human intelligence. In: R. J. Sternberg & J. C. Kaufman (Eds.), *Evolution of Intelligence* (pp. 27–54). Mahwah, NJ: Lawrence Erlbaum.

Bricsson, K. A. (2002): Attaining excellence through deliberate practice: Insights from the study of expert performance. In: M. Ferrari (Ed.), *The Pursuit of Excellence Through Education* (pp. 21–56). Mahwah, NJ: Lawrence Erlbaum.

Davidson, J. E. & Sternberg, R. J. (1984): The role of insight in intellectual giftedness. *Gifted Child Q* **28(2)**, 58–64.

Hettinger, H. R.; Kipp, K. & Goldman, M. M. (2003): *Cognitive Inhibition in Gifted Children.* Poster session paper presented at the 2003 Annual Meeting of the American Educational Research Association, Chicago, IL.

Kranzler, J. H.; Whang, P. A. & Jensen, A. R. (1994): Task complexity and the speed and efficiency of elemental information processing: Another look at the nature of intellectual giftedness. *Contemp. Education Psychology* **19**, 447–459.

Robinson, N. M. (2000): Giftedness in very young children: How seriously should it be taken? In: R. C. Friedman and B. M. Shore (Eds.), *Talents Unfolding: Cognition and Development* (pp. 7–26). Washington, DC: American Psychological Association.

Shore, B. M. (2000): Metacongnition and flexibility: Qualitative differences in how gifted children think. In: R. C. Friedman & B. M. Shore (Eds.), *Talents Unfolding: Cognition and Development* (pp. 167–187). Washington, DC: American Psychological Association.

Sternberg, R. J.; Grigorenko, E. L. & Ferrari, M. (2002): Fostering intellectual excellence through developing expertise. In: M. Ferrari (Ed.), *The Pursuit of Excellence Through Education* (pp. 57–83). Mahwah, NJ: Lawrence Erlbaum.

Tannenbaum, A. J. (1983): *Gifted Children Psychology and Education Perspective.* New York, Macmillan.

Tao, Wenzhong (1994): Mathematical education strategies of gifted children. *Educational Science Research* **5**, 28-32.

Xu, Youbiao (1995): Teaching principle of gifted children in secondary school. *Educational Science Research* **4**, 24–25.

Yao, Benxian (1995): Research and educational thinking of gifted Chinese children. *Forum on science and technology, China* **1995**, 46–49.

Zhang, Lian (2004): A review of overseas research on cognitive development in gifted children. *Chinese Journal of Special Education* **2004**, 75–79

Zhu, X. & Simon, H. A. (1987): Learning mathematics form examples and by doing. *Cognition Instruction* **4**, 137–168.