

Modification on Physics Teaching Program for Gifted and Talented Children

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Introduction

The physics teaching program for gifted and talented children at Beijing No. 8 Middle School differs from the nation's normal middle school in three aspects:

(1) Students' age

Normal middle school students begin to learn physics at the age of fourteen, whereas the gifted and talented children begin at the age of ten.

(2) Teaching aim

On national average, most senior middle school graduates will enter the society through screening by Nation's Matriculation Tests since the nation's universities provide limited spaces for the graduates, whereas the gifted and talented children will all enroll university study after four years of special course.

(3) Schooling period

Normal school students complete their physics study within five years, taking 560 class-hours, whereas the gifted and the talented complete their physics study within three years, taking only 390 class-hours.

From the above aspects, the physics teaching program available for normal middle school students must be modified

to develop a more effective teaching program to fit in with the age and psychological characters of the gifted and talented children.

Objective of the Special Classes for Gifted and Talented Children

To foster the children to take keen interests in science, arouse their curiosity in nature, encourage them to dig at subjects, cherish a high aspiration.

To help the children understand and acquire progressively the basic ideas and fundamentals of scientific research and primarily utilize the fundamentals in their study.

To help the children establish into their memory an integrated structural knowledge of physics and turn the knowledge into an active part of their intelligence, thus making them become competent for solving problems.

Principles of Gifted Physics Education

The physics education for the gifted and talented is not simply a knowledge teaching

but a sub-system of the entire system of qualification cultivation for the future scientists. Compared with normal schooling, the gifted education stresses development of thinking ability, scientific method and creative attitudes.

The role of physics teaching is mainly to provide gifted and talented children with physics education environment that will arouse their thirst for knowledge and stimulate their interests in physics. This will enable them to build up a fundamental frame and intelligent structures in a short time, based on new knowledge and go further toward development of intelligence.

Creativity

Promotion of creative thinking abilities should be put in the first place. The following ideas are of importance in promoting creative thinking abilities.

(1) In class teaching, teachers should provide the children with an atmosphere that is full of discussion and interesting and encourage them to be active in thinking, imagination and reach a conclusion independently.

(2) In physics teaching, teachers should progressively introduce to the children fundamentals of scientific methodology.

(3) To help the children understand that a truth has both objectiveness and relativity and a concept is changeable. Students will

realize that physics is a developing science which is constantly modified, replenished and improved by discoveries of new nature laws.

(4) To stimulate the children in their initiatives of self study which is considered a valuable creative activity for a person.

(5) Teachers should strengthen experiments and extra-curricular scientific activities which provide students with good opportunities to develop their creative thinking and hand-working abilities.

Receptibility

Although the children are all intellectually gifted, they are, after all, only ten years old. Program planning for their capability development should be parallel to their age level, their receptibility, and thinking level.

Acceleration

Acceleration requires condensing class teaching contents and increasing the complexity of knowledge. It results in advanced placement in physics learning, but dose not go beyond their receptibility. Advanced placement enables the children to contact directly with advanced modern theories.

Researches found that the effect of

educational background on the development of intelligence is more significant than that of inherent cause. Adequately increasing the density of class teaching contents and complexity of knowledge will facilitate speeding up of intellectual development of the children, these will also present challenges to the children, providing an atmosphere with pressure that stimulates the children's ardour for study, and fostering their hard working and inflexible will.

Laying Equal Stress on Knowledge Learning and Skill Development

Educators around the world are increasingly paying attention to the skill development of students. The physics education for the gifted children is aimed at development of the following basic abilities:

- (1) Memory ability
- (2) Observation ability
- (3) Hand-working ability
- (4) Thinking ability
- (5) Reading comprehension and writing abilities
- (6) Mathematics utilization abilities in solving physics problems

Interests

Interests will bring students a motive power in study. Teachers should make curriculum planning to stimulate the children's interests

in physics learning.

Psychological Adaptation

Learning is psychologically a joint progress of intellectual and nonintellectual factors. Curriculum program should be fit in with the children's psychological adaptability.

Curriculum Program

The physics curriculum program for gifted was basically not beyond the program provided by Nation's Educational Ministry for nationwide middle schools, but some special requirements and modifications were made to meet the needs of the gifted and talented. The program aimed at intensifying basic skills, laid stress on the theoretical basis and rigorous attitude towards mathematics while introducing a new concept and deducing a law.

The program mixed the two cycles of physics education of normal primary and senior middle schools into an integrated cycle, condensing the class hours of 560 to 390.

Teaching Strategies

Strategies in physics teaching for gifted and talented are summarized as follows:

- (1) Giving prominence to concept derivation upon concept teaching
- (2) Understanding the physics laws through observation and discussion
- (3) Dividing each unit into five steps: presentation of problems, derivation of concept, observation of regulars, establishment of laws, and utilization of the acquired knowledge
- (4) Trying to induce students conflict in cognition which results in discord between existing knowledge and new knowledge, thus making each lesson an exciting intellectual approach.

the psychological directing was considered the key to the success of the planned program.

Table 1 Curriculum Planning for Class 3 of Gifted & Talented

School Year	first 9/89-7/90		second 9/90-7/91		third 9/91-7/92		forth 9/92-7/93	
Term	1	2	1	2	1	2	1	2
Weeks	0	8	17	17	17	17	17	14
C/week	0	3	3	3	4	4	4	5
Teaching Contents	Mechanics				Thermo. & Electr.	Electr.	Opt. & Mod. Phy.	Rev. & Exer.

Notes: C/week - Classes/week
 Thermo. - Thermodynamics
 Electr. - Electricity
 Opt. & Mod. Phy. - Optics and Modern Physics
 Rev. & Exer. - Overall Review & Exercises

Program Evaluation

The Class 3 of gifted and talented children were enrolled in the modified physics program. It was found that with the modified program the thinking abilities of the children developed more rapidly than average high school students. Most of them were capable of designing and performing experiment of physics and analysing the results independently. Their average results in the National Matriculation Physics Tests were in the top place in Beijing.

In conclusion, program planning should be aimed at the development of the children's intelligence, with fostering creative thinking in the first place, and

Table 2 Comparison of the Results of the Nation's Matriculation Physics Test of 1993

	NHSE of WDOB	HSG of No. 8 M.S	Graduates of Gifts and Talents
Age at Graduate	18	18	14
Total Class Hours Taken	560 (45min/C)	560 (40min/C)	390 (40min/C)
Average Results of NMPT	73.29	89.72	96.54

Notes NHSG - Normal High School Graduates
 WDOB - Western District of Beijing
 HSG - High school Graduates
 No. 8 M.S - No. 8 Middle School of Beijing
 NMPT - National Matriculation Physics
 (min/C) -- minutes/class hour