Innovation on Mathematics Curriculum and Textbooks in China

Content

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Background

During the first two decades of the 21st century China will concentrate its efforts on building a well-off society of a higher standard in an all-round way for the benefit of its 1.3 billion people. It will further develop the market economy, improve democracy, advance science and education, enrich culture, foster greater social harmony and upgrading the texture of life for the people. In the first two decades of the 21st century, China shall face a complex and changeable international situation and more acute competition on the market, and shall actively meet and take full advantage of the challenges and opportunities of economic globalization, and in this context, China will have no other choice but implement the strategy of rejuvenating the country through science and education, the strategy of sustainable development. In order to better respond to the socioeconomic changes, China has carried out a serious of education reforms, among which curriculum innovations draws great attention worldwide and plays a significant role in educating 230 million primary and secondary school students.

What does China take curriculum reform? Although the national 9-year compulsory curriculum designed in 1992 has greatly contributed to educational development and guaranteed that all pupils got their training of basic knowledge and abilities, the curriculum was felt to be inadequate in a number of ways. The contents and ways of learning/teaching were overloaded and too difficult for pupils to complete. A lot of knowledge or curriculum contents were backward and fell behind due to rapid development of socioeconomic environment and huge advance in science & technology. The curriculum ignored to some extent individual development and student's creativity and hand-on ability. The design and implementation of curriculum was too centralized, and the development and ability of locally-based and school-based curriculum were very weak, which might fail to address learning needs of students in different parts of China.

From 2000, on the basis of experiment in some regions, China has made a lot of endeavors for curriculum reform preparation and implementation. China studied curriculum/learning standards in over 30 countries including the USA. Renewing the educational notions and ideas including personal growth, improving the design and implementation of teaching and curriculum with the personal growth and the spirit of new era, China's Ministry of Education (MOE) developed and issued the *Guidelines for the Curriculum Reform of Basic Education* in 2001. Learners' needs as well as the expectations of parents and community were taken care of. After consulting 1200 educational, psychological, subject experts, MOE organized a new circle of design and development of a curriculum for K-12 education. The new curriculum consists national curriculum, provincial curriculum and school curriculum.

The MOE developed national curriculum standards, including all core curricular areas, namely Chinese, math, foreign languages (English as well as Russian, Japanese, French), moral education

for grade 1-12, primary science (grade 3-6), integral science (grade 7-9), physics(grade 8-12), chemistry(grade 9-12), biology(grade9-12), history (grade 7-11),geography (7-11). If a middle school offers integral science, it may not offer physics, chemistry, biology. At middle school level, there are two alternatives. But at high school level, physics, chemistry and biology are taught respectively. The MOE sets guidance for provincial level curricula designing, yet does not interfere in its autonomy. Likely, each school may set its own school based curriculum. According to teaching hours, national curricula consist of 80%, provincial curricula consists 15% and school curriculum consists 5%.

With permission from MOE, one can edit textbooks according to national curricula. Before selling to school district, the textbooks have to be sent to MOE and got approved by the National School Textbook Examination Commission. So far, there are about 10 sets of textbooks being used in the country. Besides, some publishing houses may just produce two or three kinds of textbooks and are of less influence. Similarly, each province may organize and examine textbooks according to provincial curriculum. But if the textbooks go beyond the province boundary, they have to apply for approval from MOE. A school curriculum is not encouraged to have textbook, instead, various activities could be conducted along with it.

The new curricula aims to foster learners' commitment to the nation, formulation of appropriate values, awareness of one's social and legal responsibilities, readiness to engage in productive work and to continue learning throughout life, to be a responsible citizen. Such curricula shall enable learners:

- To understand China's history and her current status, and thus be ready to assume responsibilities for their personal and national development, and at the same time to respect other nations and their cultures and to be ready to participate in international development and communication.
- To master the basic skills for reading, writing and arithmetic operation, basic knowledge for culture and science; to express themselves, to communicate with others, to process information, to learn basic labor skills, so that they can adapt effectively to the learning society.
- To develop, through observation and experience, a scientific understanding of the environment, sustainable development and ecological ethics, and to be able to identify, analyze and solve problems in their daily life.
- To understand and care for the society, to form appropriate moral values and behavioral habits, ready to serve the people and the community.
- To develop sound self-awareness and independent personality and to take good care of life, learn to rationally plan for and assess one's own development and to cope with disappointments in social life; to be accustomed to regular physical exercise and proper living habits;
- To develop healthy interest in appreciating the beauty of nature, society, science and art; to be inclined to join in different cultural activities. It is envisaged that this can be achieved by emphasizing science and technology, using information technology, encouraging critical and creative thinking, broadening scientific and technological knowledge and promoting vocational efficiency.

From 2001, over 550 counties started pilot the new curricula during their compulsory

education period, usually beginning from grade 1 and grade 7. By the year 2005, all primary and middle schools in all counties in the whole country's 33 provinces, municipalities and autonomous regions carried out the new curricula. In 2004, 4 provinces began to pilot the curricula at their high schools. In 2006 altogether 10 provinces carried out the new high school curricula. Before the year 2008, most of provinces are advised to conduct the new high school curricula.

1 The mathematics curriculum in Primary & Middle Schools

Chinese Mathematics Curriculum Standard for Full-time Compulsory Education issued in 2001 gives more emphasis on the development of students' feelings and synergies with science. The attempts were made in its content system to reflect the learning characteristics of students. With greater innovation in structure, the Standard is formulated in such a way that the four educational fields are running through all the three educational stages (Stage 1: grade 1 to grade 3; Stage 2: grade 4-grade 6; Stage 3: grade 7 to grade 9). On the implementation of the curriculum, the standard requires teachers to transform their teaching idea, and clearly provides the contents and orientation of teacher's training.

1.1 The standard of the contents

Greater innovation has been made in the structure of the contents with an attempt to reflect the learning laws of mathematics. An overall arrangement and planning are made in the new *Standard* on the teaching contents for students at compulsory educational stage. On the contents and structure, full elaborations were made on such contents of standard as the "number and algebra", "space and figure", "statistics and probability," "practice and comprehensive application".

First, at overall structure level, the four educational fields of the new *Standard* are presented to the students in different stages displaying the upward spiral structure system of the contents of mathematics, which are in conformity with the learning laws of the students. In addition to such contents as traditional "number and algebra", "space and figures", "statistics and probability" was included and strengthened. Moreover, the "practice and comprehensive application" was added in the new Standard, the practice of which not only reflects the interdependence of each content but also its interrelationship between each content of the mathematics, enhancing the flexibility and elasticity in the teaching process.

Second, in the elaboration of specific targets of each content, not only such traditional requirements are included as "understanding", "comprehension", "getting to know", "grasp", "flexible application", but new terms such as "experience", "knowing from experience", "exploration", "appreciation" also added, which reflects the new idea of the curriculum. On the contents of the number and algebra, the original upward spiral structure of the number, equation to inequality and function was left unchanged. The exploration of laws in the first and second educational stage was added to enable students' learning process progressing to the stage of thinking and to the vigorous exploration of mathematical activities

On the contents of the space and figure, in addition to that previous understanding of figure, measurement and the location of the figure as well the proof etc were left unchanged, the emphasis is on the teaching of the figure transformation with a view to teach students in the first educational stage the fundamental knowledge of the transformation of geometry. And detailed target and tasks have been prescribed in the three stages of education. In the third stage i.e. from Grade 7 to Grade 9, the elementary knowledge of coordinate geometry—figure and coordinate was established, the student are able to understand the diversity of geometry and change such a false view that geometry is Euclidean geometry

On the contents of the "Statistics and probability", the uncertainty was put forward in the first stage of learning so that the students in primary school understand that Mathematics is not only dealing with certain phenomenon but also dealing with uncertain phenomenon, avoiding the emergence of such false views as "mathematics is a science that deals with certain events with certain answers for questions, and that learning mathematics is to memorize correct answers". With such measures, the students are able to have a full understanding of what is mathematics in their early ages. "Practice and the comprehensive application" are added contents, the purpose of which is to assist students comprehensively utilize their knowledge and experience to solve comprehensive and challenging problems directly related to their life experience through their voluntary exploration and cooperation and exchanges with a view to develop their capability in solving problems and deepening their understanding of the contents of the other 3 fields and understanding their interrelations i.e. the interrelations between knowledge within mathematics and comprehensive application; the application mathematics in other subjects(for example: physics, chemistry, biology, geography and computer etc); the application of mathematics in actual life.

1.2 The mathematics curriculum implementation

It has to be depending on the forefront teachers to put the new *Standard* into practice and make reforms and innovations. Therefore, the training for the teachers is the key to achieve the target. In 1960s, a mathematics teaching reform movement took place in America. It emphasized the structure of mathematics curriculum, the concept and equation as well as the student's exploration capability. A teacher is only a *facilitator* of the students in learning. Some people complained that the concept could never be updated therefore it was ended with the low learning performance and the decrease of the thinking capability of the students. The failure was not due to the idea of the reform but due to the insufficiency of the teacher's training. The forefront teachers did not grasp the idea of the reform.

The new *Standard* of mathematics in China demands teachers to update their mentality and in the same time establish the scope and orientation of the teacher's training. It can be summarized into 5 aspects: 1) forester the idea of the mathematics for the masses; 2) truly consider the students as the master of the learning; 3) correctly understand the role and position of a teacher and establish the roles of a teachers as the researcher, learner and cooperation partner; 4) consider the teaching process of mathematics as a true process of mathematical activities; 5) a correct, rational and overall-oriented evaluation standard should be established.

1.3 Features of the mathematics curriculum

The reform to the curriculum should be geared both to international practice and to China's present situation.

Many aspects of foreign curricula have been incorporated in the making of China's new mathematics *Standard.* Hence there is no wonder that it is with international contents. However, our curriculum should be suited to the actual situation of China as well as to the learning features of Chinese students.

First, considerations are made in modifying the contents of the curriculum to take care of the actual needs of the students in their life. The *standard* enables students to grasp necessary knowledge and skills on the one hand, appropriately sets up certain difficulty level on the other hand so as to develop students' minds. But mainly difficulty level was reduced. Some educators say the new math *standard* should not have deleted so many contents. They argue that although some math contents may not stay in foreign textbooks, as long as students can learn and without bringing too much learning burdens, should still be in China math curriculum. For instance in geometry, some theorems of the circle was deleted in new *Standard*. The grasp of these theorems will enable students to gain a comprehensive understanding of the geometry and if properly utilized they can arouse the strong interests of students in mathematics.

Second, the difficultness and thinking intensity of the curriculum are suited to the existing capability of the students. The curriculum of mathematics is more thought-oriented. Now, let's take geometry system as an example, with traditional teaching contents, what the primary school students learn and grasp is only limited to the knowledge of figure. Students may not comprehend nature of three-dimensional space in Euclidean geometry, nor really knowledge about coordination and geometry in statistics. While in the new *standard*, the transformation of geometry is added.

Third, with regard to the curriculum design and teacher training, the emphasis is put on the application of psychology as well as timely utilization of the latest research results of the psychological sector. A student psychological developmental rule is taken into account at classroom teaching. It is widely believed that to grasp children's psychological law is of importance both in math curriculum design and to educational researchers as well as to the forefront math teachers.

Mathematics curriculum reform is connected to the entire curricula reform.

The new math *Standard* puts emphasis upon the application of Mathematics, connection between Mathematics and living practice, and synergies between Mathematics and other subjects. Developer of Mathematics once worked together with the developers of other curriculum standards and jointly conducted a lot of researches. In Mathematics, such contents as computer and science ought to be questioned to see whether the contents involved in have already established foundation for students in pertinent subjects, whether the basic concepts of these contents have already been introduced, whether the students have clearly understood these phenomena. As a result, considering the course reform as a whole will be in favor of realization of new course idea to a greater degree. In concrete teaching, Mathematics teachers should

communicate not only with each other, but also with teachers of correlative subjects in a greater degree. If so, it will be in favor of the overall arrangement of students' composite activities, enabling the exploratory contents to be more suitable for students and promote the development of students' composite qualities farther.

Meanwhile respecting students' personality, their sense of responsibility to learn has been further emphasized.

The new *Standard* pays respect to student's personality development, but it also tries to form student's responsibility to learn, to care, awareness as a citizen in the modern society. Being processed by teachers, some interesting Math material in itself can be learned by students while working and playing, which can reinforce students' interest to learn Mathematics, as well as can develop the students' capability to analyze and solve the mathematic problems of this kind. From this angle, the opinion of "learning Math happily" has positive meaning. But one must recognize that after all math can not be mastered well completely only in happiness, students need to pay out certain hard-working efforts for most math contents, and then taste sweetness therein.

2 Mathematics textbooks in high schools

Mathematics Curriculum Standard of High Schools aims at helping high school students develop calculation skills, math consciousness, space concept, encouraging quick learners to learn more and prevent slow learner from being frustrated. Thus, high school math *standard* proposes required math1-5 and elective math 1-5. All students have to learn required math, but they can choose any elective math to learn accordingly.

In the light of the *standard*, some sets of math textbooks were compiled with fundamental nature, diversity, and selectivity, meeting the social requirement of the contemporary era, reflecting scientific advancement, attaching importance to the developing process of knowledge, and fitting in with learning of high school students. Among these sets of math textbooks of high schools, the one that the People's Education Press under MOE compiled is well accepted, which covers required courses from Math 1 to Math 5, all together five volumes, and the elective course 3-4, "Symmetry and Group" one volumes.

2.1 Characteristics of the high school math textbook

This set of math textbooks published by the People's Education Press has placed stress on embodying the fundamental nature, diversity, and selectivity of new course of high school math, comprehensively fulfilling the essential ideas related to math, Math course, Math learning, Math teaching, evaluation, and employing information technology, and striving to give prominence to the following characteristics.

Affinity: initiate interest and learning impassion with vivid and vigorous presentment style.

Select typical and abundant material which closely related to the contents and well-informed among students, set up a kind of learning situation representing Mathematics concept and conclusion, Mathematics idea and method, and Mathematics application, to make students

produce affinity to Mathematics and create the impulse of "discovering what happen on earth", and then throw themselves into learning with abundant interest.

Nature of question: guide Mathematics activities by means of questioning, cultivate sense of questioning, and inoculate innovation spirit.

At the "key point" of the knowledge coming into being, at the "articulation point" to make strategy of solving problems through Math method of thinking, at the "junction point" among mathematical learning, at the "diverging point" Mathematical problem variant, and within the "zone of proximal development" of students' thought, through such columns as "Observation", "Thinking", and "Inquisition", put forward suitable questions which can enlighten the students Mathematical thought in moderation, and guide their thinking and exploration activities, enabling them essentially improve their learning style while undergoing the basic process of such rational thinking as observation, experiment, conjecture, ratiocination, communication, and rethinking.

Scientific and thinking nature: through the connection and enlightenment of different Mathematical contents, put emphasis on the utility of such thinking methods as analogy, generalization, specialization, and method of variation, to learn thinking form of Mathematical questions, enhance Mathematical thinking capability, and cultivate rational spirit.

This set of textbook has paid more attention to make use of the internal relation of Mathematical contents, in order to mutually link up different Mathematical contents, and raise the integral understanding level to Mathematics for the students. Specifically, such thinking methods as analogy, generalization, specialization, and the method of variation have been emphasized in this textbook, displaying the following typical logistic thinking method utmost:

Generalization

↑

Analogy←Current content→Analogy

↓

Specialization

The aim is to enable students experience the fundamental rules of mathematical exploration activities, gradually master ratiocination method in virtue of mathematical symbols and logistic relationship, hunt after new fact and reasoning conjecture, develop students' savvy and potential to understand the "number" and "figure" nature of objects and rules, and to dispose pertinent logistic relation, in order to fall into the habit of logical thinking, and go forward with expression and communication orderly and logically.

Temporal spirit and adaptability: establish situations by materials with temporal spirit and reality, to develop sense of application.

Establish situations in virtue of these materials with era feature, reflecting reform and opening, and market economy, and embodying social construction achievement, to guide students, through their own mathematical activities, extract "number" and "figure" qualities from objects, seek after commonness and essential connotation from certain phenomena, and further abstract math conception and conclusion, in order to enable students come through mathematical discovery and creation process and understand the cause and affect of knowledge.

Set up such columns as “Observation and Conjecture”, “Reading and Thinking”, ”Research and Discovery”, and “Application of Information Technology”, in order to offer students abundant alternative materials with thinking nature, practicality, challenge, and reflecting Mathematical essence, prolong the mathematical activity space for students, and farther develop their consciousness of “learning Mathematics” and “using Mathematics”.

Connection nature: construct a selectable and structural textbook system with different levels.

This textbook has strived to layer the Mathematical contents, on the inherent basis students owned, according to mathematical learning rules, requirement of pertinent contents in different modes and intrinsic logical relation of Mathematics, organizing the learning contents step by step and in a uprising method like screw.

2.2 Explanation on the contents of the textbook

This set textbook includes: all compulsory courses, five volumes from Mathematics 1 to Mathematics 5, and one volume of elective course 3-4 “Symmetry and Group”. This set of textbooks has been compiled in accordance with the module in the “Standard”, trying to stand out the specific Mathematical education function of each module in the design of system structure, and representing the connection and comprehension of pertinent contents, and coming into being a organic whole. This textbook has tried to provide expansive teaching and learning space of Mathematics, in order to mobilize activeness of teachers and students and actually implement the progress of teaching method and learning style.

On the base of inheriting our excellent tradition of Mathematics education, we are striving for innovation, and in this set of textbook concretely practice the “characteristics of the textbook” suggested in project-building report.

Put emphasis upon the background (practical and inside Mathematics) and application of Mathematics knowledge in a greater degree, enabling the students feel natural and ripe to learn Mathematics, add the affinity to the textbook.

For instance, in the pertinent contents of function, through typical and abundant detailed examples (relating to motion change, environmental change, and economic life, etc), display the producing background of function concept, in order to let students understand how to realize the correlative dependence relationship among variables in the world with function, and farther draw out function concept naturally; and through detailed examples display the actual background of exponential function, logarithmic function, power function, trigonometric function, making students understand that different changing phenomena should be described with different functional models; through examples, guide students compare the growth diversity of such different function categories as straight line climbing, exponent explosion, and logarithmic growth; and through detailed examples, let students understand the process that trigonometric function depicts periodical change rules; etc.

Put forward good questions employing all available means, show students the method of questioning, representing “question nature”, and guide students to learn on their own initiative, with more interest, and rich in exploratory, exactly improving the learning style of students.

For instance, try to start with questions at the beginning of each paragraph; clearly put forward questions on such columns as "Observation", "Thinking", "Research" to guide students' Mathematics activities, urging them earnestly observe the quantitative relation and geometrical characteristic reflecting in the detailed examples, and actively conduct experiments and activities of conjecture, induction, and reasoning, consider the essences of the questions, seek for the means to solve the questions, enabling them generalize Mathematics concept, achieve Mathematics conclusion via their own exploration thinking, to discovery the answers, solve the problems, master Mathematics thought, and understand the essence of Mathematics; in the margin of the textbook, put forward the concrete questions in the process of Mathematics questions coming into being with "question mark-shaped" icon; in brief summaries, put forward questions from the top of relationship of knowledge and Mathematics thinking method, guiding students to master pertinent knowledge from the integral structure of Mathematics; and in exercises and review questions, guide students to present expansive questions.

Enhance the process and relationship, organize the contents of textbook under the developing process and logical relation of Mathematical concept, giving the textbook scientific nature; take core concept and fundamental thoughts (number and its operation, function, spatial concept, combination of numbers and figures, vector, derivative, statistics, notion of random, and algorithm, etc.) as the "spirit" of the whole textbook, promoting the thinking nature of the textbook.

For instance, in the preface of each chapter, it tries to lead out the content need to learn in this current chapter in a big background, enabling students understand the status of functions of this current chapter; in summary of each chapter, except for concluding the knowledge structure of the current chapter, especially emphasize on conclusion of the current chapter from the height of Mathematics thinking method, generalizing the connection between the knowledge of the current chapter and pertinent contents, and trying to express by means of "logical map" which embodies such processes as analogy, generalization, specification; in Analytical Geometry, pay attention to guide students to taste the fundamental thought of analytical geometry every where, and sum up "three steps" to solve geometry questions algebraically through examples; in Trigonometric Function, study trigonometric function by means of unit circle, and sum up the thought among that (especially the combination of numbers and figures concept); in Probability and Statistics, fully make use of random phenomena, ask students experience the meaning of statistics thought and probability, through their handwork, and understand the difference of the conclusions between statistics and determinacy, etc.

Under the principle of facilitating the course teaching & learning and on the basis of absorbing the advantages of traditional teaching materials, we'll try to materialize the basis and acceptability of ***textbook*** *via "highlighting outlines"; and the new contents in the reform of* ***mathematics*** *course of high school will be precisely planned strictly in conformity with the criteria.*

In respect of basic arithmetic, under the objective of enabling students to "realize the philosophy, importance and validity of the arithmetic, develop their abilities for self-consistent ideology & expression and improve logical thinking abilities", the contents of arithmetic are planned in two modes: first, in Chapter I "Basic Arithmetic", typical examples (solution of simple

equation with two unknown, solution of quadratic equation with one unknown, primer number judgment, and function graphing and sequencing) are employed to introduce philosophy, basic structure and sentence of arithmetic, and then "successive division and mutual subtraction algorithm method", "Qin Jiushao arithmetic", "sequencing" and "scale" are used in guiding students to imitate, operate and explore, so that the students can design flow chart in practical operation to express the process of solution; Second, the ideology of arithmetic spreads in other relevant contents if possible, such as the function application (approximate solution of dichotomy equation), crossing-point coordinate solution of function graph, establishment of functional model for solution of practical problem, summation of sequence of numbers and solution of inequation.

*Actively develop an integration of **mathematics** course with information technology, and properly materialize the application of information technology.*

Information technology is a powerful cognition tool. During the compilation of textbooks, we have attempted to facilitate the student to realize the essence of **mathematics** by leveraging information technology: first, a special column "information technology application" introduces the application of information technology, such as "approximate solution of equation in virtue of information technology", "data collection & establishment of function model" and "drawing tangent function graph with tangent line"; second, if applicable, "Calculator or computer can be used as well…" will prompt the use of information technology, such as discussion of function graph and nature, growth difference comparison of different function models, evaluation, calculation of regression coefficient. In consideration that China features a vast territory with different economic levels and the hardware level of information technology largely varies, the **textbook** presents specific requirements for the use of calculator and marginal notes for the contents to be completed by computer only. The teacher & student books will include complementary introductions on the use of information technology.

*Try to materialize scientific values of **mathematics**, and reflect decisive role of **mathematics** in promoting the progress of other sciences & the whole culture.*

In light of the teaching contents, a development history of **mathematics** is introduced in details so as to reflect the application of **mathematics** in a simple way, guide the students to realize scientific value, application value & cultural value of **mathematics** and improve their scientific & cultural accomplishment and awareness of application in two modes: first, in creative columns, a history, culture & application of **mathematics** are introduced in combination with relevant contents, such as "development history of the function concept", "invention of logarithm", "equation solution in both Chinese & foreign histories", "descriptive geometry and Monge-Ampere equation", "cyclotomy", "quality control chart in production process", "cognition process of weather change", "probability and cipher", "trigonometry & astronomy" and "amplitude, period, frequency & phase"; Second, the introductions are available in the margins of the text, such as brief introduction to some **mathematician** and notes to some **mathematical** terms.

*Lay stress on the different needs of the students for **mathematics**, and offer different development potentials for students besides basic contents.*

Columns such as “observation & guess”, “reading & thinking”, “research & discovery” and “information technology application” are developed with efforts to provide students with some original contents (such as “number of elements in aggregate”, “relationship between function graphs of two inverse functions”, “weak/strong dependency relation”, “ period of the function y＝Asin(ωx＋φ) & function y＝Acos(ωx＋φ)” and “where the error exists”) as well as thoughtful contents (such as “invention of logarithm”, “Euclid Script and axiom method”, “Cartesian & analytic geometry”, “studying the nature of sine & cosine function by trigonometric function line in the unit circle” and “operation (operational rule) and graph nature of vector”); “Observation”, “thinking”, “research”, questions in the margin of a page and vacancy-filling question are employed to guide the exploration activities of students and provide them with space for independent learning.

*The development of the teaching resources including teacher’s book synchronizes with the compilation of **textbook** so as to incarnate the concept of new **mathematics** course for the high school.*

To materialize up-to-dated teaching concept of **mathematics** in teaching and guide teachers’ teaching with teacher’s book, we’ve developed teacher’s book as well. The analysis on the teaching contents explains the compilation objectives, adds the part on how to design teaching context to guide students’ teaching and offers some cases.

2.3 Structure and Style of the math textbook

Structure

Required Course Mathematics 1

Sets, Functions and Elementary Functions I

Chapter 1 Sets and Concepts of Function

1.1 Sets

1.2 Functions and Their Expressions

1.3 Basic Properties of Function

Practices

Chapter 2 Basic Elementary Functions

2.1 Exponential Functions

2.2 Log Functions

2.3 Power Functions

Chapter 3 Applications of Functions

3.1 Functions and Their Equations

3.2 Function Models With Applications

Practices

Required Course Mathematics 2

Introduction To Solid Geometry and Plane Analytic Geometry

Chap. 1 Space Geometric Objects

1.1 Structure of Space Geometric Objects

1.2 Three-View Diagrams and Visual Diagrams of Space Geometric Objects
1.3 Surface Area and Volume of A Space Geometric Object
Practices
Chap. 2 Positional Relations of Points, Straight Lines and Planes
2.1 Positional Relations of Space Points, Straight Lines and Planes
2.2 Criterions and Properties of Parallel Lines and Parallel Planes
2.3 Criterions and Properties of Perpendicular Straight Lines and Perpendicular Planes
Chap.3 Straight Line and Its Equations
3.1 Continuing Table of Inclination Angles and Slopes of Straight Lines
3.2 Equation of A Straight Line
3.3 Intersection-Point Coordinates of Lines and Distance Formula
Chap.4 Circle and Its Equation
4.1 Equation of A Circle
4.2 Relative Position Between A Line and A Circle
4.3 Space Rectangular Coordinates

Required Course Mathematics 3
Elementary Algorithm, Statistics and Probability

Chap.1 Elementary Algorithm
1.1 Algorithm and Flowcharts
1.2 Basic Algorithm Statements
1.3 Algorithm Example
Chap.2 Statistics
2.1 Random Sampling
2.2 Estimation of Population With Samples
2.3 Correlation Between Variables
Practices
Chap.3 Probability
3.1 Probability of A Random Event
3.2 Classical Probability Form
3.3 Geometric Probability Form

Required Course Mathematics 4
Trigonometric Function, Plane Vector and Trigonometric Identical Transform

Chap.1 Trigonometric Function
1.1 Angles and Radian Measure
1.2 Trigonometric Functions of A Measuring Angle
1.3 Induced Formulas of Trigonometric Functions
1.4 Images and Properties of Trigonometric Functions
1.5 The Image of The Function Y＝Asin（ΩX＋Φ）
1.6 Simple Applications of Trigonometric-Function Models
Chap.2 Plane Vectors
2.1 The Real Background and Elementary Conceptions of A Plane Vector

2.2 Linear Operation of Plane Vectors

2.3 Elementary Theorems and Coordinate Representation of A Plane Vector

2.4 Scalar Product of Plane Vectors

2.5 Application Examples of Plane Vectors

Chap.3 Trigonometric Identical Transforms

3.1 Formulae of Sine, Cosine and Tangent of Sum Or Difference of Two Angles

3.2 Simple Trigonometric Identical Transforms

Required Course Mathematics 5

Triangle Resolving, Sequences and equations

Chap.1 Triangle Resolving

1.1 Continuing Table of Sine Theorem and Cosine Theorem

1.2 Application Examples

Practices

Chap.2 Sequence

2.1 Sequence Concepts and Their Expressions

2.2 Arithmetical Sequence

2.3 Sum To N Terms of An Arithmetical Sequence

2.4 Geometric Sequence

2.5 Sum To N Terms of A Geometric Sequence

Chap.3 Inequality

3.1 Inequality Relation and Inequality

3.2 Quadratic Inequality With One Unknown

3.3 Linear Inequality (Inequalities) With Two Unknowns

3.4 Basic Inequality $\sqrt{ab} \leqslant \frac{a+b}{2}$

Selective Course 1 Book1

Common Logical Terms, Conic Sections and Their Equations, Derivatives and Applications

Chap.1 Common Logical Terms

1.1 Proposition With Relations

1.2 Sufficient Condition and Necessary Condition

1.3 Simple Logical Conjunctions：Meanings of ‘Or’, ‘and’ and ‘Not’

1.4 Universal Quantifier and Existence Quantifier

Chap.2 Conic Sections and Their Equations

2.1 Ellipse and Its Equation

2.2 Simple Properties of Ellipses

2.3 Parabola, Hyperbola and Equations

2.4 Applications of Conic Sections

Chap.3 Derivatives With Application

3.1 Rate of Change and Derivatives

3.2 Derivatives and Calculation

3.3 Application of Derivatives In Functions Analysis

3.4 Examples of Optimized Problems In Daily Life Practices

Selective Course 1 Book2

Stat. Cases, Inference and Proof, Extension of Number System and Introduction of Complex Number

Chap.1 Stat. Cases

1.1 Case1: Test of Independence (2×2 Col. Table)

1.2 Case2: Statistical Hypothesis

1.3 Case3: Clustering Analysis

1.4 Case4: Regression Analysis

Chap.2 Inference and Proof

2.1 Reasonable Inference

2.2 Deductive Inference

2.3 Continuing Table of Analytical Method and Synthetic Method

2.4 Proof By Contradiction

2.5 Axiomatic Conception and Computer Proof

Chap.3 Extension of Number System and Introducing of Complex Number

3.1 Extension of Number System

3.2 Basic Concepts of Complex Number

3.3 Expression and Geometric Meaning of Complex Number

3.4 Four Arithmetic Operations of Complex Number

Chap.4 Block Diagram

4.1 Flow Chart

4.2 Structural Diagram

Selective Course 2 Book 1

Common Logical Terms, Conic Sections and Equations, Vectors In Space and Solid Geometry

Chap.1 Common Logical Terms

1.1 Propositions With Their Relations

1.2 Sufficient Condition and Necessary Condition

1.3 Simple Logical Conjunctions：Meanings of ‘Or’, ‘and’ and ‘Not’

1.4 Universal and Existence Quantifier

Chap.2 Conic Sections and Their Equations

2.1 Standard Equation of An Ellipse

2.2 Simple Properties of Ellipses

2.3 Standard Equation of A Parabola

2.4 Simple Properties of Parabolas

2.5 Standard Equation and Simple Properties of A Hyperbolic

2.6 Conic Sections With Simple Applications

2.7 Curves and Their Equations

Chap.3 Space Vectors and Solid Geometry

3.1 From Plane To Space—Space Vectors and Their Operations

3.2 Vector-Method In Solid Geometry

Selective Course 2 Book 2

Derivatives With Application, Inference and Proof, Extension of Number System

Chap.1 Derivatives With Application

1.1 Rate of Change and Derivatives
1.2 Derivatives of Familiar Functions
1.3 Operation of Derivatives
1.4 Application of Derivatives In Functions Analysis
1.5 Examples of Optimized Problems In Daily Life
1.6 Concepts of Definite Integral
1.7 Fundamental Theorem of Calculus
Practice

Chap.2 Inference and Proof

2.1 Reasonable Inference
2.2 Deductive Inference
2.3 Continuing Table of Analytical Method and Synthetic Method
2.4 Proof By Contradiction
2.5 Mathematical Induction
2.6 Axiomatic Conception and Computer Proof

Chap.3 Extension of Number System and Introduction of Complex Number

3.1 Extension of Number System
3.2 Basic Concepts of Complex Number
3.3 Expression and Geometric Meaning of A Complex Number
3.4 Four Arithmetic Operations of Complex Numbers

Selective Course 2 Book 3

Counting Principle, Stat. Cases, Probability

Chap.1 Counting Principle

1.1 Classification Counting Principle and Step-By-Step Counting Principle
1.2 Permutation
1.3 Combination
1.4 Binomial Theorem

Chap.2 Statistics and Probability

2.1 Discrete Random Variables and Their Distributions
2.2 Conditional Probability and Independence of Events
2.3 Expectation and Deviation of Discrete Random Variables
2.4 Normal Distribution (Gaussian Distribution)
2.5 Statistical Cases

Selective Course 3 Book1

Math History Selection

Lecture 1 The Early Arithmetic and Geometry----Count and Measurement

1. The Math Recorded In Straw-Paper Book (In Ancient Egypt)

2. The Math Recorded In Mud-Board Book (In Tigris & Euphrates Drainage Area)
3. Chinese < Arithmetic Scripture In Zhou Dynasty> and Pythagorean Proposition (Zhao Shuang's Diagram)
4. Decimal Development

Lecture 2 Math In Ancient Greece

1. Pythagorean Polygon Number, From Pythagorean Proposition To Pythagorean Number, Incommensurable Problem
2. Euclid and His < Element>
3. Archimedes's Work: Stereometry

Lecture 3 Math Treasures In Ancient China

1. The Math In <Nine Chapters On The Mathematical Art> (Equation Method, Elimination By Addition & Subtraction, Positive & Negative Number)
2. Method of DAYAN QIUYISU (Sun Theorem)
3. Introduction To Ancient Chinese Mathematicians

Lecture4 The Produce of Plane Analytic Geometry----The Combination of Number and Shape

1. Functions and Curves
2. The Significance of Cartesian Methodology

Lecture5 The Produce of Calculus----An Epoch-Making Achievement

Lecture6 The Two Giants In Modern Math----Euler and Gauss

1. Euler's Math Instinct
2. The Characteristic of Gaussian Times (Mathematical Strictness) Continuing Table

Lecture7. An Age-Old Puzzle---- Galois's Solution

1. From Abel To Galois (A Middle School Student Mathematician)
2. Three Hang-Ups In Geometric Construction
3. The Produce of Modern Algebra

Lecture8. Cantor's Set Theory----Considering The Infinite

1. Infinite Set and Its Potency
2. Russell's Paradox and Infrastructure of Mathematics (G**ö**del'S Incompleteness Theorem)

Lecture9. Development of Stochastic Idea

1. The Source of Probability Theory
2. The Origin of Statistics

Lecture10 Course of Algorithmic Idea

1. Historical Background of Algorithm
2. The Algorithm In Computer Science

Lecture11 Development of Chinese Modern Mathematics

The Glorious Course of Modern Chinese Mathematician's Endeavor In Overtaking The Edge of World Mathematics

Summary and Report

Selective Course 3 Book2

Information Security & Cipher

Lecture1 Knowledge About Elementary Number Theory

1. Divide Exactly and Modular Arithmetic; Completely Congruence Class With Mod M and Simplified Residue System; Ruler's Theorem and Fermat's Theorem, Problem of Big Number Decomposition
2. Definition of Ruler Function and Its Formula; Wilson's Theorem and Its Application In Primary Number Discrimination; Primitive Root & Exponent; The Existence of Primitive Root For Modular P; Problem of Discrete Logarithm

Lecture2. The Application of Number Theory In Information Security

1. Concepts In Communication Security; Fundamental Problems In Communication Security
2. An Example of Ancient Cipher: Stream Cipher（Use Congruence Modular M）
3. Public Key System; Methods of Encipher and Digital Signature
4. The Application of Discrete Logarithm In Cipher Key Exchange and Distribution
5. The Application of Discrete Logarithm In Encipher and Digital Signature
6. The Application of Lagrange Interpolation Formula In Cipher Key Share

Summary and Report

Selective Course 3 Book 3

Geometry On Spherical Surface

Lecture1 Introduction To Spherical Geometry

1. Real Problems of Spherical Geometry (Such As Problems In Measure, Aviation and Satellite Orientation)
2. Spherical Graph and Plane Graph
3. Symmetry Property of A Spherical Surface
4. Fundamental Graphs On Spherical Surface

Lecture2 Properties of Spherical Triangles

1. Extending The Properties of Euclidean Plane Graph To Spherical Surface (The *S*. *S*. *S*，*S*. *A*. *S*，*A*. *S*. *A*)
2. A Congruence Theorem of Spherical Triangles -- *A.A.A* Theorem
3. Area Formula of A Unit Spherical Triangle （S＝A＋B＋C－Π）
4. Angle Sum of A Spherical Triangle
5. Proof of Euler Formula

Lecture3 Formulae of Spherical Triangles

1. Spherical Cosine Theorem（Cosc＝Cosacosb＋Sinasinbcosc）
2. Pythagorean Theorem On Spherical Surface
3. Spherical Sine Theorem（$\frac{\sin A}{\sin a}=\frac{\sin B}{\sin b}=\frac{\sin C}{\sin c}$）
4. Spherical Triangle Formulae and Plane Triangle Formulae

Lecture4 PoincarÉ Model

Summary and Report

Selective Course 3 Book 4

Symmetry and Group

Introduction

Lecture1 Symmetric Groups of Plane Graphs

1. Plane Rigid Motion
2. Symmetric Transform
3. Symmetric Groups of Plane Graphs

Concepts of Symmetry and Abstract Groups In Algebra

1. N-Ary Symmetric Group Sn
2. Symmetric Transformation of A Polynomial
3. Concepts of An Abstract Group

Lecture3 Story About Symmetry and Group

1. 带饰和面饰
2. Symmetric Groups of Chemical Molecules
3. Classification of Crystals
4. Galois Theory

Summary and Report

Selective Course 3 Book 5

Euler Formula and Classification of Closed Surfaces

Lecture 1 Euler's Formula

1. Classified Plane Graphs With Transformation
2. Euler Formula

Lecture 2 Classification of Closed Surfaces

1. Triangulation of Surfaces
2. Euler Characteristic of Surfaces
3. Visual Meaning of A Topological Transformation
4. Topological Invariant and Classification of Lines and Closed Surfaces
5. Application of Topological Idea

Summary and Report

Selective Course 3 Book6

Trisection of An Angle & Number Field Extension

Lecture1 Trisection of An Angle Problem and Geometric Construction

1. Three Geometric Construction Problems In Ancient Greece
2. The Basic Thought of Solving Angle Trisection Problem
3. Geometric Constructing A Segment At The Length of Rational Number
4. Geometric Constructing A Segment At The Length of $\sqrt{a}$

Lecture2 Number Field and Its Extension

1. Rational Number Field and General Number Field
2. Number Field Extension and Examples

Lecture3 Discussion On Angle Trisection Problem

1. The Algebraic Explanation On Angle Trisection Problem
2. Proof: Incapable of Trisection For A Sixty Degree Angle By Geometric Construction
3. The Applications of Solving Geometric Problems By Means of Algebra

4. De Moivre Formula For Complex Multiplication
5. Plotting A Regular 17-Gon In Geometric Construction

Summary and Report

Selective Course 4 Book 1

Selection of Geometric Proofs

Lecture1 Theorems About The Relation Between Circles and Straight Lines

1. Properties of Similar Diagrams
2. Theorems About The Relation Between Circles and Straight Lines

Lecture2. Probe The Properties of Conic Section

1. The Meanings of Parallel Projection
2. Intersection Line of Plane With Circular Cone and Relevant Proofs
3. Dandelin Spheres and Ellipse

Summary and Report

Selective Course 4 Book 2

Matrix and Transformation

Lecture1 Second-Order Matrix and Transformation

1. Second-Order Matrix
2. Multiplication of A Second-Order Matrix and A Plane Vector, Transformation of Plane Graphs
3. Composite Transformation -- Multiplication of Second-Order Square Matrixes
4. Inverse Matrix and Second Order Determinant

Lecture 2 Matrix Application

1. Second Order Matrix and Linear Equations In Two Unknowns
2. Invariant of Transformation

3.Matrix Application

Summary and Report

Selective Course 4 Book 3

Sequence and Difference

Lecture1 Difference of A Sequence

1. Concept of Sequence Difference
2. First Order Difference of A Sequence
3. Second Order Difference of A Sequence
4. Some Properties of Difference and Sequence

Lecture2 Linear Difference Equation(S)

1. Linear Difference Equation
2. Linear Difference Equations

Lecture3 Examples of Non-Linear Problems

1. Equation Xn＋1＝Kxn（1－Xn）
2. Examples of Complexity On Non-Linear Problems

Summary and Report

Selective Course 4 Book 4

Coordinate System and Parameter Equation

Lecture1 Coordinate System

1. Variation of Plane Graphs With A Stretch In A Plane Rectangular Coordinate System
2. Polar Coordinate System
3. Equations of Some Simple Graphs In Polar Coordinate System
4. Introduction To Cylinder Coordinate System and Spheric Coordinate System

Lecture2 Parameter Equation

1. Parameter Equation of A Parabolic Motion Orbit
2. Parameter Equations of Straight Lines, Circles and Conic Sections
3. Comparing Parameter Equations With Ordinary Equations
4. Parameter Equations of Plane Cycloids and Involutes
5. Reading Material: Generating Process of Cycloids and Examples of Application

Summary and Report

Selective Course 4 Book 5

Selection of Inequality

Lecture1 Inequality and Absolute Value Inequality

1. Inequality
2. Absolute Value Inequality
3. Solution For Absolute Value Inequalities

Lecture2 Cauchy Inequality

1. Different Forms of Cauchy Inequality and Its Geometric Meaning
2. Proof of Cauchy Inequality
3. Discussion On General Case of Cauchy Inequality
4. Application of Cauchy Inequality
5. Sequencing Inequality

Lecture3 Mathematical Induction

1. Principle of Mathematical Induction
2. Simple Applications of Mathematical Induction
3. Bernoulli Inequality With Its Application

Lecture4 Methods For Inequality Proofs

1. Comparision Method
2. Synthetic Method
3. Analytical Method
4. Proof By Contradiction
5. Zoom Method

Summary and Report

Selective Course 4 Book 6

Introduction To Elementary Number Theory

Lecture1 Integer and Exact Division

1. Congruence and Congruence Class
2. Exact Division
3. Exact-Division Discrimination of An Integer

Lecture2 Division Algorithm

1. Greatest Common Divisor of Two Integers
2. Solution For Linear Diophantine Equation
3. Linear-Congruence-Equation Model

Lecture3 Several Important Theorems of Elementary Number Theory

1. Sun Theorem
2. Fermat Theorem
3. Euler Theorem
4. Number Theory Applied In Cipher – Open Cipher Key

Summary and Report

Selective Course 4 Book 7

Optimum Seeking Method and Preliminary Experimental Design

Lecture1 Introduction To Optimum Seeking Method

1. Optimization Problems In Daily Life
2. Fraction Method, 0.618 Method and Their Applications
3. Fibonacci Sequence and Golden Section
4. Bisection Method, Mountain Climbing Method and Batch Testing Method
5. Processing Method of Multimodal Objective Function
6. Optimization Problems of Double Factors and Multi-Factors

Lecture2 Preliminary Experimental Design

1. Experimental Design In Daily Life
2. Orthogonal Testing Design Method
3. Simple Application of Orthogonal Testing Design Method

Summary and Report

Selective Course 4 Book 8

Overall Arrangement Method and Preliminary Graph Theory

Lecture1 Overall Arrangement Method

1. The Overall Arrangement Idea and Its Application Example
2. The Basic Concept of Overall Arrangement Method
3. Overall Arrangement Graph Plotting
4. Calculation for Parameters of Overall Arrangement Graph
5. The Critical Path of Overall Arrangement Graph and Its Algorithm
6. Simple Applications of Overall Arrangement Method

Lecture2 Introduction To Graph Theory

1. Elementary Concepts and Functions of Graphs
2. Spanning Tree of Graphs and Its Algorithm
3. Shortest Path Problem of Graphs and Its Algorithm

Summary and Report

Selective Course 4 Book 9

Risk and Decision

Lecture1 Risk Decision In Daily Life and Economic Business

Lecture2 Increase and Decrease Matrix, Exploring of Decision Approach and Method, Meaning of Decision Results

Lecture3 Decision Tree; Decision With The Method of Retro-Decision Tree

Lecture4 Sensitivity Analysis of a Risk Decision

Lecture5 Markov Decision and Its Methods

Summary and Report

Selective Course 4 Book 10

Switching Circuits and Boolean Algebra

Lecture1 Introduction To Switching Circuits

1. Two States of Switching Circuits and Their Structure
2. Parallel Circuits, Series Circuits, Reverse Circuits and Their States Determine
3. Basic Problems of Switching-Circuit Design, the Design Problem of A Specific Circuit

Lecture2 From Switching Circuits To Boolean Algebra

1. Boolean Algebra Based On Switching Circuits
2. Operational Laws Satisfied By Boolean Algebra (Compare With Arithmetic)
3. Boolean Polynomial and Its Standard Form (Compare With Algebra)
4. Transform Between Switching Circuits and Boolean Polynomials
5. Boolean Functions and The Fundamental Theorems
6. Lecture 1 Solution of Three Types of Problem

Lecture3 Functions of Boolean Algebra In Computer Circuit Design

Lecture4 Boolean Algebra and Proposition Calculus

1. Simple Proposition and Composite Statement
2. Boolean Algebra Induced By Proposition Calculus
3. Boolean Algebra Is Abstracted From Two Kinds of Things With Quite Different Qualities

Lecture5 Review and Summing-Up

1. Significance of Boolean Algebra, Boolean Polynomial and Boolean Function In Switching Circuit and Propositional Calculus
2. Compare Boolean Algebra, Boolean Polynomial and Boolean Function With Arithmetic, Algebra and Function of Number System
3. History of Boolean Algebra

Summary and Report

3 Characteristics of Mathematics Curriculum in Basic Education

Firstly, "mathematic thinking", "sensibility & attitude", "knowledge and skill" and "problem solution" are listed as four key objectives, which materialize the priority on sensibility & thinking ability development of students and reflect the spirit of the time.

The "mathematic thinking" objective gives priority to cognition progress of mathematics and points out that students will undergo mathematic activities such as observation, experiment, guess and demonstration and develop their sense of digits and symbols as well as concept of space and statistics so as to develop abstract thinking. In essence, the students are required to grow into "mathematics-conscious" thoughtful persons.

The "sensibility & exchange" objective gives priority to the development of students in sensibility field and points out that students should "be able to take part in mathematics learning enthusiastically, be interested in the mathematics and thirst for knowledge". It lays stress on "acquisition of success experience" in students' learning and enabling student to actively "experience mathematics activities filled with explorations & creations" and to establish self confidence in learning mathematics and to develop the attitude of seeking truths from facts and the habit of query and independent thinking. This objective specifies a role of "active learning" for the students and fully realizes the spirit of the time i.e. people foremost in modern education. It reveals that learning of mathematics should become a key component of the spiritual life of students instead of pure "tool" acquisition process.

The "knowledge & skill" objective also materializes a new concept: enable students to realize and experience the occurrence and development process of mathematic knowledge so as to grasp mathematic knowledge and develop basic mathematic skills. It gets rid of an out-of-dated learning mode such as rote, mechanical learning, knowledge points and "Practice makes perfect" from excessive questions.

The "problem solution" objective differs from traditional "trouble shooting". It stresses "a question formulation and understanding in virtue of mathematic angle", and the question formulation is originally listed among the contents. In addition, the "problem solution" objective refreshes previous "development of independent thinking and trouble-shooting abilities" with "learning to cooperate with others and exchange the thinking process and results with others". It gives priority to the teamwork and cooperation ability of people in IT society.

Secondly, the objective of new math standard and the textbooks proposes step-by-step development by grade and takes into account the age and cognition abilities of students, giving priority to context, essence and application.

For example, in respect of knowledge & skill objectives, the students in Grade 1-3 are required to abstract a number from daily life; the students in Grade 4-6 are to abstract number and simple quantitative relation from daily life; the students in middle school (Grade 7-9) are to abstract symbols from specific contexts. Different experiences feature different hierarchies. Accordingly, we should try to realize the similarity and difference between daily life, actual life and specific context, and design teaching contents and organize the teaching.

The innovation of math curriculum enables students to realize the actual context and application value of mathematics contents, guiding them to grasp the essence of mathematics and understand generation process of mathematics concept and conclusions, improving their mathematic thinking ability and laying down a sound mathematic basic for their life-time learning and development. The practical application skills and work-related experiences and competencies will be similarly developed among students (learning to do). In addition to the State-prescribed

compulsory courses, schools at the grassroots will be able to arrange more elective learning programs according to the particular needs of the learners and the local community. In practice, primary schooling is mainly organized around the core curriculum. The elective courses are to be introduced in secondary schools.

Thirdly, the new math standard tends to promote integration of math and science, in order to foster student's scientific spirit and improve their hand-on competence.

The structure of the curriculum is more or less integrated, balanced and adapted to involve disciplines in learning areas, more focus on integrated courses rather than well-defined subjects. The new curriculum is composed of interdisciplinary contents and integrated courses so that the learners may link their math skills to practical science questions. In math curriculum, some deliberately man-made questions are deleted, leaving students more time for solving questions related to their life experience and/or science issues.

The integrated courses will play the main role in primary school. In middle high schools, there are disciplinary subjects as well as integrated courses but encouraging the experiment of integrated courses. For high school, disciplinary subjects still play the key role but the model and content need to be revised. It will be relevant to society, technologies/sciences and students' development by introducing "integrated practices" through supervised research, community services, labor-skill training and other trainings necessary for the promotion of the students' problem-solving capabilities.

In the time of knowledge explosion and rapid advance in science and technology, particularly for IT to be quickly popularized, first of all, we should be aware of what knowledge is most useful and common to human beings. It is essential, for curriculum reform to shift from the overload of knowledge and teaching/learning to benefit the students' development. Pupils should foster basic knowledge and skills that have been carefully chosen. It is more important for students to foster the scientific spirit and methods, and the ability of collecting and dealing with knowledge or information. That is, learning to know, which not only needs fostering the basic knowledge but also including the development of values and attitudes as well as methods? IT education will be more important, and introduced and expanded in primary and middle schools across the country in the next five to 10 years.

Through stressing on history, ideology and culture, students are enabled to find out the relationship between mathematics, scientific & technological progress and social development and to grasp philosophy and cultural value of mathematic science, foster their rationalism and correct concept towards mathematics.

Fourthly, improve learning activities of students, and foster their awareness of originality. Abide by the cognition rules, give attention to individual difference, advocate diversified learning modes, try to create a space of independent research, cooperation and exchange for students as well as original teaching environments for teachers, provide democratic atmosphere and rich resources for an interactive teaching between teachers and students, facilitate students to probe into questions and foster students' awareness towards originality and application.

Fifthly, Paying attention to an application of ICT. In mathematics, ICT is leveraged to present new contents that previous teaching materials and other teaching instruments could hardly

provide. This greatly actualizes organic integration of ICT with the contents of mathematics course so that students can understand the essence of mathematics, actively explore and study mathematics.

The new math *Standard* seems not good enough in the following aspects: the thorough understanding of international teaching practice as well as its integration with China's present situation; the *standard* needs to reflect the spirits of the mathematics for the masses and with more elasticity. On the cultivation of students, too much emphasis is put on the respect over student's feelings but less on the sense of responsibility. In order to get rid of the above weaknesses, MOE has organized revision of the mathematics curriculum *standard* and will publicize a new version in 2007.