

# The Study of the Computer-Assisted Cartography Instruction

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**Abstract** In this paper, the cartography and the Computer-Assisted Instruction (CAI) were introduced, the necessary of every course education about cartography was put forward, and the Computer-assisted map mathematical base instruction was tested, it proved the feasibility of the Computer-Assisted Cartography Instruction, and the frame of the cartography was established.

**Keyword** cartography, Computer-Assisted Instruction, map mathematical base

## 1. Introduction

Computer-Assisted Instruction (CAI) was a new and modernized technology of education. With the use of computer, CAI could help or take the place of a teacher to pass on knowledge and training skills to the students. The alternative practice between students and the computer could help the students to understand better and know well the science and knowledge. Thus, the effect of the teaching results could be improved, and the computer could be used proficiently by the students.

Cartography was a science which studied the map、 drawing up skills of the map. It studied how to show the spatial distribution, connection and dynamic changing about the nature and the sociality. The traditional teaching methods were difficulty to meet the development of the cartography and request of the map production today. There was a problem about the inheriting and reforming.

Today, the development of computer technique was very fast. It provided a good opportunity to reform the traditional teaching methods.

## 2. The system of the Computer-Assisted Cartography Instruction

The teaching process included two subjects, they were the teacher and the students. So the system of the computer-assisted instruction might include two bodies, they were the system catering to the teacher and the system being geared to the needs of the students. The teacher system was used to show teaching, and the student system was used to review and practice etc. after class. The system structure of computer assisted cartography instruction was showed in fig.1.

(1) Knowledge library. Its content included conceptions、 principles、 formulas、 and main point's about this course etc..

(2) Model library was used to leave with wall maps、 molds、 the base structure of the main map etc.

(3) Question library was used to leave with the exercises and the examination questions.

(4) Recording library concentrated the records of practice and examination.

(5) The system of showing teaching. Several courses were divided according to the contents and steps. The system could be used by the teacher to replace the explaining and showing in class.

(6) Practice system. It provided the exercises to the students and used man-computer interaction to answer the problems asked by students.

(7) The examination and analysis system. It was responsible for providing text and analysis results.

(8) The teaching analysis system. The teaching results could be analyzed synthetically according to the information after examining and answering. All of this provided the references for the teacher to modify the teaching plan.

(9) Interface management. The characters, sounds, pictures, cartoons etc. were used synthetically. The man-computer interaction could help the teacher and students exchanging each other.

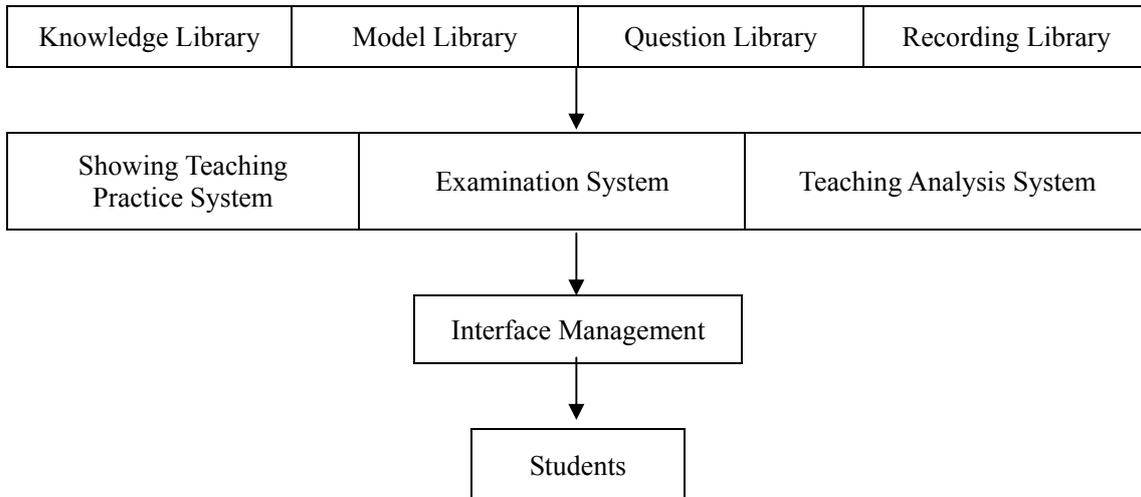


Fig.1 The System Structure of Computer-Assisted Cartography Instruction

### 3. The Experiment Study

#### 3.1 The Design of the Script

The script design was concerned with the teaching contents and teaching tactics. When the scripts was designed, you might notice that, the interface might be please to the eyes to attract the people; The aim might clear and lay stress on the key points; It might be convenient to operate.

The serious of the base scale topography were using the Guss-Krüger Projection and Conical Equalagle Projection with Two Standard Parallels. The principles of these two projections were introduced on the screen with the animation and the sketch map. It's purpose was to help the teacher to interpret in the course.

#### 3.2 The mathematical base demonstrated in the class

##### 3.2.1 The map's sheet and number

Before to display the mathematical base with the graph, we must calculate the map's sheet and number. The Sheet and Number's nature standard of the national base scale topography was formulated in 1991 in our country.

In the national new base scale topography, a unique character represented the scale. The scale character base was built, as table 1. According to the scale, the character could be searched for, and the gap of longitude and latitude should be known.

Table1

Scale	1:1 000 000	1:500 000	1:250 000	1:100 000	1:50 000	1:25 000	1:10 000	1:5 000
Character	A	B	C	D	E	F	G	H
Longitude gap (minute)	360	180	90	30	15	7.5	3.75	1.875
Latitude gap (minute)	240	120	60	20	10	5	2.5	1.25

The number of 1:1 000 000 topographic was formed by lines and row characters. The new

national standard provided the integrate rules from the 1:500 000 to 1:5000. The topography's number was replaced by different characters: Aa Bb Z Cc Dd. Aa substituted for the 1:1 000 000 topography's line character, Bb substituted for the 1:1 000 000 topography's row character. Z substituted the map's row number. The programming was under the Borland C++ environment. Then a dialogue was formed. Thus the student could examine the calculate resells.

According to the number, we could calculate the longitude and latitude about the map outline. If you know the map number, then the line and row characters of the 1:1 000 000 topography Aa and Bb could be known, the scale number Z and the line and row character Aa, Bb of the map also could be known. According Z, We could search for the map's longitude and latitude gap in the scale character base, they were representative by dL and dF. Thus, The longitude and latitude of the southwest outline (represented By WSX and WSY) could be calculated:

$$WSX=(Bb-31)*360+(Dd-1)*dL$$

$$WSY=(Aa-1)*240+(240/dF-Cc)*dF$$

The Longitude and latitude of the easenorth outline (represented by ENX and ENY) were calculated:

$$ENX=WSX+dL$$

$$ENY=WSY+dF$$

The unit of the calculated result was minute. It should be covered to the degree, minute and second, and to be showed in the dialogue.

It was also to calculate the number by giving the scale and any longitude and latitude in the map: When the scale was given, you can search the scale character Z and revert longitude gap dL and latitude gap dF. The longitude and latitude of the point was represented by L and F, the formulation of the number calculation were

$$Aa=[L/360]+31$$

$$Bb=[F/240]+1$$

$$Cc=[(L/360)/dL]+1$$

$$Dd=240/dL-[F/240/dF]$$

Among them: [ ] represented the fraction value, was the round number

( ) represented the reaming value

When you clicked the Calculation button, the coordinates of the westsouth outline and the eastnorth outline will be calculated.

### 3.2.2 The calculating and drawing of the outline

The outline of the map generally includes the inner and outer outline. The outer outline was the straight line. The inner outline would be determined according to concrete coorditive. The number of the national base scale topography caculating was according to the longitude and latitude. In the size, all the outlines were curve lines etcept the east west outline of the 1:1 000 000 topography. But when the curvature was within the threshold limit value, it would be substitute for the straight line. The point number of the national base scale topography had unified set.

According to the unified point number, the longitude of the added outline point could be calculated. (The latitude was not change)

$$XA=ENX+(WSX-ENX)*i/n \quad (I=1,2,\dots,n-1)$$

#### 3.2.2.1 The calculation of the map projection correlation

In the national base scale topography, the 1:1 000 000 topography adopted the projection of

Conical Equalangle Projection with Two Standard Parallels. The other scale sets were adopt the Guss-Krüger Projection . The place right angle coordinate of every ink in the inner outline could be calculated by the two projection coordinate formula.

#### 3.2.2.2 Mathematics base demonstrate graph

The inner outline could be drawn out according to the coordinate. The link line of every inner outline angle point was extended toward out fixed length, the out outline and the middle outline could be drawn out. The screen graphics included outline line, coordinate grid-line, the magnetic north line, divided degree band, the feature out of the map. These could assist the teacher to teach in the class.

#### **Reference**

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