Study on the Curriculum Reformation of Computer-cartography Mapping

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Abstract: Based on the requirement of Surveying and Geographical Information System's professionals training, this thesis is about to introduce the curriculum targets and the teaching specialty of Computer Cartography, and the problems in the status of current education, and some investigation about the curriculum reformation.

Key words: Computer-aided mapping, Curriculum reformation; Surveying, Geographical Information System

1 Introduction

Computer cartography is one of the major courses in Surveying Engineering and Geographic Information Systems (GIS), and mainly teaches about how to achieve digital map / digital map features computer cartography techniques. This is a highly practical course, finally in order to enable students to grasp the theory of computer cartography and algorithms to develop their own electronic map works. This paper starts from cultivating Surveying Engineering and GIS professionals and elaborating the position and effects of "Computer Cartography" in the Surveying Engineering and GIS education curriculum system, analyzes the existed problems in the current teaching work, and investigates the curriculum reformation.

2 The position of Computer cartography in the personnel training of Surveying Engineering and GIS

Cartography Education is the major part of Surveying, Geography and Geology in the universities. With the development of Computer Cartography, in the education of GIS, Surveying, Resources Environment and Urban Planning, Geological, we not only need to highlight the basic theory of traditional teaching of Cartography, but also to emphasize the application-oriented computer cartography skills. Therefore, many universities offer courses like "Computer Cartography", "Computer Graphics and Digital Mapping" in GIS and Surveying. To cultivate students onto the basic principles, skill and method of computer cartography and to gain the certain technical capacity, are also the major content of cultivating qualified GIS and Surveying.[1]

"Computer Cartography" means a lot in cultivating professionals in GIS and Surveying. Mainly because Cartography has significance in these two majors: ①Map design and production technique are the key technologies for geodetic surveying, engineering surveying and global positioning system to obtain the geographic data visualization. ②Map Projection, cartographic languages, map perception and cartographic situation are the foundation and the basic theory of geographic information analysis. ③Measuring and Setting are based on map or projection design drawing. The basis of survey engineer is theory of reading map and analysis method.[2] ④The development of computer cartography plays a powerful role in promoting the GIS.

3 About learning materials

Computer cartography is from the cross of computer graphics and map cartography, and is closely related to Surveying, Mapping, Computer Programming, RS, GIS, etc. Although, the domestic has set up similar programs in many colleges and universities, there are not enough useful learning materials.
There are only six learning materials, such as "Computer Cartography" (HuYou-yuan, Huang Xing-Yuan editor (1987)) and "Principles of Computer Cartography" (Xu Qing-rong etc editor (1993)). They can no longer be used for now. The comparison of the learning materials is bellowed in Table 1.

<table>
<thead>
<tr>
<th>Textbook Name</th>
<th>Main content</th>
<th>The scope of application of</th>
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<tbody>
<tr>
<td>&quot;Computer Cartography&quot; (Sun Yi-yi, 2000)</td>
<td>The computer cartography technology and computer programming to implement electronic maps and digital maps</td>
<td>The learning materials of GIS, Computer Graphics</td>
</tr>
<tr>
<td>&quot;Computer Cartography&quot; (Ai Zi-xing, etc., 2005)</td>
<td>The basic principles and methods of computer cartography; the detailed description of computer cartography system and application development process</td>
<td>The learning materials of colleges and universities majors</td>
</tr>
<tr>
<td>&quot;Computer graphics principle and method of the map&quot; (Du Pei-Jun, etc., 2005)</td>
<td>The basic principles, basic methods, and basic applications Materials of the computer cartography</td>
<td>The learning materials of Surveying, GIS, Resources Environment and Urban Planning, Land Resource Management, and reference book of other majors such as Water Conservaney, Geological and Mining, Geography</td>
</tr>
<tr>
<td>&quot;Principles of computer cartography and the basic algorithm&quot; (Yan Hao-wen, etc., 2007)</td>
<td>The basic principle and algorithm of the computer cartography</td>
<td>The learning materials of Surveying and Geography</td>
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</table>

Since our school opened "Computer Cartography" in 2003, the curriculum has mainly based on "Computer Cartography" (Sun Yi-yi, 2000). The main reasons are: ①When this course began from 2003, there are 44 teaching hours and 20 laboratory hours, therefore a book with theory and practice is quitly needed, and the book by Sun yi-yi is the latest. ②After the cultivation plan is modified in 2004, there are 20 teaching hours and 12 laboratory hours left. Although there are more books can be used after 2005, because of the limitation of teaching hours, it is impossible to finish all the teaching in time, so we still keep on using the book by Sun yi-yi.

4 Current problems in teaching

Surveying Engineering and GIS focused on cultivating multi-disciplinary knowledge and integration of cross, but there are some problems due to the current education:

4.1 The cultivate plan need to be further developed, and the convergence between the curriculum need to be improved.

To learn "Computer Cartography", students need to have some indispensable basic knowledge, including Borland Delphi development environment, Object Pascal programming, data structure and basic knowledge of database, and basic concept of OOP, software engineering and the etc. For instance, the object-oriented programming concept of polymorphism is required in advance. But in the real cultivation plan, some courses can’t be lectured before us, then the student can’t study this better.

4.2 Insufficient preparation in the basis of interdisciplinary field of knowledge, affect the availability of cultivate innovation

Recently, GIS which is based on electronic map, is being used more and more popular. The database management and compute analysis function were merged into it, and then GIS becomes a more
developed information tool to help on decision making. Electronic map using the computer cartography is a new map form, which affect the study of GIS.  

4.3 Teaching material problem
There are only 6 teaching materials in computer cartography. There are difficulties in choosing proper learning materials, so we should organise experienced teacher to prepare teaching materials.

5 The direction and the content of the reformation revolution

5.1 Building the education system and teaching content organization base on the development ideas
As the development of computer science and information technology, especially with the greatly improving of personal computer’s processing ability, with the rapid development and updating of the graphic processing equipment, the computer cartographic will become an indispensable technical mean in the social life. Therefore, computer cartography, electronic map and GIS are rapidly developed. The structure of the education system changes in computer cartography. The concrete embodies should include the following five areas:

5.1.1 The basic principles of computer cartography
The modem cartography theory is the main line of computer cartography. The cartographic information theory and the cartographic communication theory which are based on information theory, are the core theory of computer cartography; the theory of map perception and the cartography symbols theory provide scientific basis for transforming computer cartography from a best understanding map into a visualization; the map model supplies reliable guarantee for the application of modern computer cartography.

5.1.2 Software development for Computer Cartography System
With the steady development and perfection of software development, improvement of a lot of new technology and the constant renewal of software development tools have profound influence on computer cartography. Therefore, the theory and algorithms of computer cartography need to be constantly updated.

5.1.3 The application of Computer Cartography System
The application of Computer Cartography System introduces the application flow of the Computer Cartography System and the computer cartography software. The development prospects of computer cartography were forecast.

5.2 Highlight the major goal of the training
Surveying major is to foster the research and development personnel and the applied interdisciplinary talents, who can master the basic principles and methods of the acquisition, processing, analysis, expression and application of digital earth framework information; and study the basic theory of Engineering Survey, the modern spatial measurement techniques, the digital photogrammetry and RS, and Cartography and GIS; and lay a solid foundation of math, English, basic computer applications; and have good professional quality.
GIS major is to foster the research and development personnel and the applied interdisciplinary talents, who can master the basic principles and methods of the acquisition, processing, analysis, expression and application of geospatial information. The talents should lay a solid foundation of math, English, and basic computer applications, and study the operation technique of the information science, the natural and human geography, the digital photogrammetry and RS, and computer cartography. The talents should have good professional quality in the design, application, development and management of GIS.
In the teaching process of computer cartography, it is necessary not only to explain the basic theory, but also to attach the practical aspect. Through learning, students can master the basic theory, and use computer knowledge, and develop their own electronic map works. Then the general application ability of the students is cultivated.
5.3 Closely with practice, stress on practice
"Computer Cartography" mainly uses the visual programming language and computer cartography techniques to realize the function of electronic map. The experimental curriculum requires high on the programming ability of the students, so before each experiment, students, who have mastered the computer cartography technology, use the software engineering knowledge, to analysis demands, write reports and complete the design requirements program. Then they should take full advantage of the computer experiment to debug process, in order to achieve the required functions.

5.4 Constantly explore new methods of teaching
5.4.1 Combination of teacher teaching and students’ self-studied, focused and comprehensive radiation
The teachers should give full play to the self-learning ability and the study initiative of the students and identify the main study of each chapter and the theoretical knowledge relevant to the content; and use investigating methods to explore content subdivision; and the students accept the content briefly through self-study; and the important content is explained in detail.
5.4.2 Teaching in a developed view
Students, while reading the latest science papers, should put their knowledge to learn as a whole. While teaching, the ability of the professional integration and the accessing creative information should be trained, for learning this course needs solid foundation knowledge and the students could use this knowledge to analysis. Think, image and induct; the experimental curriculum could train the students’ practical operative ability and the application ability; at the same time, this curriculum guides the students to construct the hierarchical feature and structure of knowledge from the development of academic level; and it also can cultivate the students’ the quality of scientific research.

6 Conclusion
In our school, the course of computer cartography should carry out teaching reform. By updating teaching content, improving teaching methods, emphasizing on the practice aspect, strengthening the interaction of teachers and students, improving teaching effectiveness, the quality of teaching is improved. In short, the "computer cartography" teaching reformation should adapt to the urgent requirement of training the current reform persons, and it’s a long-term and painstaking work.

References