Practice and Discussion of Scientific Research Ability Training for Undergraduates Major in Geomatics

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Abstract. Using the School of Geomatics and Urban Information at the Beijing University of Civil Engineering and Architecture as a case, this article first explores the connotation of the undergraduate research. Then it investigates the research capability of undergraduates, followed by a detailed depiction of the implementation of the training methods such as academic lectures, practice-oriented teaching, laboratory construction and research-oriented supervisors. Finally it analyzes the problems in the trainings for the undergraduate scientific research ability in colleges and provides some suggestions. This research can provide some new ideas and new measures and will be helpful in enhancing the undergraduates’ scientific research level and promoting the cultivation of scientific research ability and innovative ability of college students across china.

Introduction

Talents specialized in survey and mapping are the vanguard of the national economic development and the national defense construction. They have gradually entered into many cross-disciplined fields such as the national security, economic construction and information service[1-5]. Colleges and universities are an important base for talent training. The cultivation of the scientific research ability of undergraduates has been widely recognized both at home and abroad as an effective way to train highly qualified and innovative talents.

This article starts from the analysis of the connotation of the undergraduate research using the School of Geomatics and Urban Information at the Beijing University of Civil Engineering and Architecture as an example. Then it probes into the research capability of undergraduates major in survey and mapping and then introduces the measures adopted in cultivating students' ability of scientific research. Then it analyzes the problems in the undergraduate scientific research ability trainings, followed which suggestions are given. This research can provide some new ideas and new measures, and play a positive role in enhancing the scientific research level of students and promoting the cultivation of the scientific research ability and innovative ability of college students in china.

Investigation and Analysis of the Scientific Research Ability of the Undergraduates Major in Survey and Mapping

Based on the understandings of the connotation of undergraduate research and the extant research, we can sum up several basic characteristics of undergraduate research[6-10]: (1) innovation. Undergraduate scientific research mainly refers to undergraduates that acquire relatively innovative knowledge through scientific research activities. This is different from the standard of undergraduate research described by the American Undergraduate Research Council: an original, intellectual or creative contribution to the development of a subject. (2) collaboration. Undergraduate students generally do not have the ability and experience of independent research. Their scientific research activities are usually conducted under the guidance of supervisors or with the help of senior students. (3) openness. In order to enhance the effects of undergraduate research activities and promote academic dialogues among students and between students and teachers, the
scientific research findings of undergraduate students should be displayed and communicated. (4) education. This is the most essential function of the undergraduate research. It is also an integral part of undergraduate education. It is one of the measures to train students' innovative ability, creative consciousness and innovative spirit.

This research probes into the undergraduate research ability of the undergraduates in the Survey and Mapping Institute through a questionnaire survey. Some samples of the questions involved as shown in the Table 1:

Table 1. Questions about the undergraduates’ scientific research ability (selected).

<table>
<thead>
<tr>
<th>Number</th>
<th>Question</th>
<th>Option a</th>
<th>Option b</th>
<th>Option c</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>There will be a new film shown in the cinema recently, what will you do?</td>
<td>Watch the movie as soon as possible, either by going to the cinema or through online watching</td>
<td>Watch the movie when hearing positive feedbacks from the students around.</td>
<td>Think that it has nothing to do with yourself or you do not care about it.</td>
</tr>
<tr>
<td>11</td>
<td>What do you like to do at your spare time? *</td>
<td>(a) Play online games with classmates in the same dormitory; (b) Play basketball; (c) Run on playground; (d) Study in the study room; (E) Bask quietly; (f) Sleep; (E) Shop, chat and eat with friends.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Do you prefer the theoretical courses or hands-on courses?</td>
<td>Theoretical courses</td>
<td>Hands-on courses</td>
<td>None of them.</td>
</tr>
<tr>
<td>13</td>
<td>What will you do when you cannot understand during the learning process?</td>
<td>Solve problems independently by searching literature and checking notes.</td>
<td>Consult your teachers and classmates.</td>
<td>It's normal to be unable to understand. Just leave it aside.</td>
</tr>
</tbody>
</table>

* Select one or more choices.

A total of 167 questionnaires were sent out, of which 131 valid questionnaires were returned. As to Questions 8 and 9, 105 students chose Option a, accounting for 81% of the total; 116 for Question 10, accounting for 89% of the total; 122 choosing the options with a group of people involved in (i.e., Options a, b, and e) for Question 11, accounting for the total number of 93% people; 86 preferring hands-on courses for Question 12, accounting for 66% of the total number; and 45 choosing Option a for Question 13, accounting for 34% of the total.

As can be seen from the analysis, undergraduates in the School of Geomatics and Urban Information have the following characteristics: (1) active thinking, full of curiosity, and having strong interest in new things. (2) outgoing, hospitality, good at dealing with people, and having good coordination skills. (3) compared with the study of theoretical knowledge, they are more inclined to take the course focusing on the practical abilities. (4) when facing difficult problems, there is tendency for them to escape. Their ability to think deeply needs to be strengthened.

Based on the investigation and analysis of the undergraduates' scientific research ability in the School of Geomatics and Urban Information, we can take measures to enhance the undergraduates’ scientific research ability.

**Measures for Improving Undergraduates’ Scientific Research Ability**

According to the current undergraduates’ scientific research situation of the School of Geomatics and Urban Information, this research has been carrying out the education and teaching reform in various aspects such as academic exchanges, practical teaching, laboratory construction and scientific research supervisor system, aiming at enhancing and strengthening the training for a higher level of the scientific research ability of undergraduates.

*First, regularly organize academic lectures on survey and mapping, expand professional horizon, and raise awareness of the scientific research.* Organizing mapping academic lectures and introducing advanced academic thoughts and theoretical knowledge in the field of Survey and mapping are good for the expansion of undergraduate professional horizons, the cultivation
students' scientific research consciousness and arousing students' passion for their major and the interest in the scientific research. The School of Geomatics and Urban Information regularly invites leading professors in the field such as Ning Jinsheng Fellow, Liu Xianlin Fellow, Chen Jun Yong Fellow, Li Deren Fellow and Zhang Zuxun Fellow to come to the school to deliver lectures. Secondly, strengthen the teaching element in the practice and reform the practice teaching mode. A typical characteristic of the teaching for the students in science and engineering is the emphasis of students' practical ability – the ability to apply the theoretical knowledge learned in the classroom to specific practice activities. Therefore, how to strengthen the practice teaching and reform the practice teaching mode is also the key to improve the undergraduate scientific research ability. In order to enhance students' practical ability, the School of Geomatics and Urban Information has organized many full-time teachers to discuss on teaching. According to the social needs and the subject characteristics, the Department of Remote Sensing Engineering raised the idea of the simultaneous development of the majors of remote sensing and photogrammetry. The Department of Geographic Information Engineering puts forward the three “1”s project to enable students to master one programming language - c#, one database management tool - SQL database and one software - ArcGIS software after the systematic and professional training. Thirdly, strengthen the construction of open laboratory platform to ensure the basic conditions for undergraduate research ability training. The university laboratories are important bases for practice teaching. To improve the laboratory hardware through humanized management is the premise to the accomplishment of the cultivation of the undergraduates’ scientific research ability. Currently there are two laboratory platforms for the subject of survey and mapping in the Beijing University of Civil Engineering and Architecture: the Key laboratory of Modern Urban Surveying and Mapping of the National Administration of Surveying, Mapping and Geoinformation and the Engineering Research Center of Representative Building and Architectural Heritage Database of the Ministry of education. The university has many advanced experimental equipments such as the UAV photogrammetry platform, the 3D laser scanner, the laser tracker and joint arm, the multi-spectral camera, the mobile mapping system, the continuous measurement of GPS reference station (CORS), the GPS RTK and Georobot and the high performance graphics workstations, ensuring the access to the hardware condition for the undergraduate students to carry out scientific research activities. Finally, strengthen and give full play to the role of supervisors in the cultivation of undergraduates' scientific and technological ability so as to make the scientific research advisor system be put into practice. Scientific research supervisor system is necessary for the innovative education. In all steps (i.e. choosing the research topic, design, experimental operation) of the scientific research, the supervisors can actively cultivate students' practical ability, strengthen students’ divergent thinking ability and stimulate and improve the innovation ability of students. The faculty of the School of Geomatics and Urban Information of University of Civil Engineering and Architecture has strong scientific research ability and rich teaching experience.

Existing Problems and Suggestions

The practical measures perform well in improving the scientific research ability of undergraduates at the School of Geomatics and Urban Information of the University of Civil Engineering and Architecture. But there still exist some problems in the promotion of undergraduate scientific research ability throughout the Beijing municipal polytechnic universities and even nationwide universities. First, there is no certification or assessment measures for the work of scientific research instructors. Undergraduates’ scientific research activities need the wholehearted participation and devotion of teachers. At present, many colleges and universities have not established the certification or assessment system for scientific research supervisors in this field, nor special incentive mechanism. Then it is very difficult to guide and stimulate the teachers to devote more time and energy in this area. Secondly, undergraduate research activities lack the supervision and management of the whole process. At present, the undergraduate scientific research activities in many colleges and universities are managed through both the university Communist League Committee and the Academic Affairs Office under the corresponding management institutions and
management measures. But the full-process undergraduate research activities lack management and supervision in the actual operation. As a result, some undergraduate research practices were not completed or poorly completed, wasting lots of research resources. Thirdly, explore the unity and the opposites between the classroom teaching and the extracurricular scientific research and reduce the number of credits required in order to provide necessary space for scientific research and training. The scientific research training of college students needs a good environment and atmosphere and a certain amount of time. On the one hand, we should explore the unity and the opposites between classroom teaching and after-class scientific research and establish a flexible scheme for training talents by bringing scientific research training into teaching plans. This will not only create conditions for students to participate in scientific research, but also provide opportunities for students to participate in other academic activities and improve their abilities and qualities. On the other hand, some students may neglect their studies as they are very likely to spend a lot of time on the entertainment affairs such as playing games and playing when the number of credits required and the teaching hours are reduced. It is necessary to further explore and study the conflict between the merits and the demerits and seek more effective programs and measures.

References


[7] Zhang Jianhuan, Yan Huang Ping and so on. Highlight the "practice" characteristics of the construction project optical fine course [J], Higher Science Education, 2009 (2).

