Research and Discussion on the Integrated Teaching Method of 'Control Surveying' and 'GNSS Principle'

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Abstract. Aim at the current situation of control measurement technology and GNSS technology, combined with the actual teaching situation of surveying and mapping specialty in university, on the basis of extensive investigation, 'Control Surveying' and 'GNSS Principle' integrated teaching method is proposed in the paper, from three aspects of teaching theory, teaching practice and course examination to reform, so as to promote the teaching and improve the professional quality of students, practice has proved that integrated teaching is feasible and effective.

Overview

'Control Surveying' is an important professional basic course of surveying and mapping engineering during undergraduate. It always attracts much concern and attention of teachers and students because of its more class time, deep theory, and wide range of content and big difficulty. 'GNSS Principle' is another important professional course of surveying and mapping, which transits from 'GPS Principle', with the GLONASS and COMPASS system realized global location or regional location.

In technology application, with the maturity of satellite technology, network of control measurement has from traditional triangulation shift to GNSS technology monopoly. Therefore ,the combination of 'Control Surveying 'and 'GNSS Principle' has been increasingly closed, the original teaching methods has been unable to meet the needs of the present study and practice, so it need to explore the new teaching, practice and examination method [1,2,3].

Course Status

Traditional 'Control Surveying' mainly solves the problem of the control measurement benchmark, triangulation and traverse network layout method, observation method, control network's optimization design, result calculation, control network adjustment and so on. There has been a complete and rigorous theory, and precision reliable practice method. However, with the rise and mature of modern surveying and mapping technology with the GNSS technology as the representative, the traditional triangulation control measurement method has gradually fade. The method of control network has gradually monopolized by GNSS technology [4].

The 'GNSS principle' course mainly solves the principle of satellite positioning system, the method of measuring, data processing, GNSS network layout and so on. At present most colleges place emphasis on the theory. On the one hand, students are not familiar with the operation of GNSS, and don't understand the layout method of GNSS network deeply enough. On the other hand, it causes the consequence of the disconnection between theory and practice.

Therefore, according to the teaching status of these two courses and the development of surveying technology, combined with the teaching experiences of 'Control Surveying 'and 'GNSS Principle' , the integrated teaching method is creatively raised. The so-called integrated teaching refers to make 'Control Surveying' and 'GNSS principle' achieve '3 synchronism', namely synchronous teaching, synchronous practice and synchronous assessment [5, 6].

Design and Implementation of the 'Integration' Program

Design of 'Integration' Program. Once ‘Integration’ is implemented, a reasonable implementation scheme must be developed, and it needs to adjust current teaching content, to pay more attention to the cultivation of students' practical ability, in order to adapt to the needs of the surveying and mapping work, and fully integrate the theory teaching and practice process.

Scheme is developed not only to meet the two basic courses teaching requirements, and complete the syllabus of the content, but also give full consideration to the actual situation of production practice and companies’ basic requirements on the skills of students, at the same time it also need to consider students’ acceptance level and time arrangement. The 'integration' program flow is shown in Fig. 1[7, 8]

Formulating scheme must be based on the extensive survey. Therefore, by surveying at the status of the surveying and mapping production units’ control measurement, the related colleges’ teaching method, the view of undergraduate of surveying and mapping on the two course, and the feedback of graduates of surveying and mapping, referring to employers’ requirements and suggestions for graduates on the basic skills, combining with the present situation of the ‘Control Surveying’ and ‘GNSS principle’, specify the initial integration scheme. Organize teaching according to the plan, After class, it need to have a comprehensive understanding of the students, after graduation to track a return visit to unit, according to the feedback information, modify the integration scheme continuously to improve the contents of the program and details.

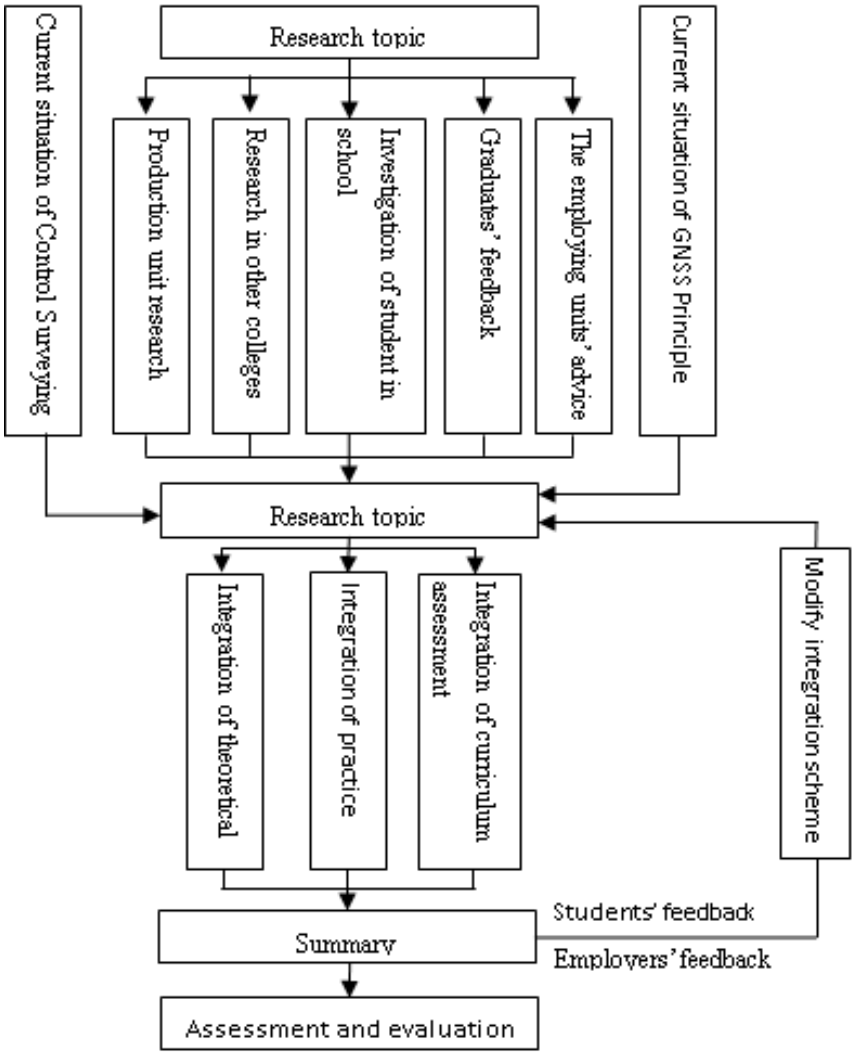

Figure 1. The process of curriculum integration

Integration of Theory Teaching. The integration of theory teaching refers to the adjustment of the two courses of ‘Control surveying’ and ‘GNSS Principle’, so that it makes the teaching, conclusion and experiment synchronous.

First, adjust the‘ Control Surveying ’ and ‘GNSS Principle ’ to the same semester, weakening the triangulation theory and method and data processing means in the' control surveying ' course, strengthen the wire and GNSS measurements, and fully integrate the production practice , focused on GNSS netting procedures and methods.

Secondly, 'GNSS Principle 'further highlight the layout method and matters needing attention of GNSS control network, especially the data calculation method of GNSS control network, and according to the requirements of the engineering control surveying, focus on teaching the precision index and application environment in different levels of GNSS control network.

Thirdly, properly adjust the teaching schedule of the two courses, carried out the related content at the same time. For example, arrange the layout method of control surveying’s control network and the layout method of GNSS principle’s GNSS network in the same period of time to teach, then according to the teaching content arrange experiment link.

Integration of Practice Link. 'Control Surveying' and 'GNSS Principle' are both theoretical and practical courses, both have 16~24 hours of experiments and 3~4 weeks of teaching practice. After the implementation of the teaching integration ,the practice link is made a larger change, unified arrange the experiment and practice of the two courses, Length of each experiment increase from 2 hours to 4 ~ 6 hours, long hours of experiments can have more practice content to be arrange. Retain the original content of the experiment, at the same time , increase the experimental requirements, for the control network’s selection and layout experiment in the 'control surveying ', on the basis of the original triangulation’s and traverse’s network selection and layout, increase GNSS network’s reconnaissance and netting, focus on practice the attention of control points choosing of GNSS network; for the experiment of GNSS network’s static observation of the 'GNSS principle', change the original 'three receivers, four points, one period' to 'three receivers, six points ,one period', focus on practice the netting forms and observation methods of GNSS network, and increase the difficulty of data processing.[9]

At the same time, adjust the time of the two courses’ practice, arrange the two practice time in the same semester and join together, Practice for a total of six consecutive weeks. Adjust practice content according to the requirements of the teaching integration, choose open area, layout control network with 10 to 12 points, use the same control points to layout and observe four - level triangulation, first - class wire mesh, E - level GNSS network, and solution. On the one hand, it expans the network’s scale, and more conducive to students to master the control network’s layout; on the other hand, observe a set of control points using different methods can evaluate the precision one by one. Through the comparison of precision index by different methods, analysis of advantages and disadvantages of the three methods can be very well. Finally, after six weeks of practice can make students master the professional knowledge, and enhance the professional skills [10].

Course Examination Integration. In the teaching integration one important link is the integration of course assessment, mainly reflected in three aspects: firstly breaking the limits of the curriculum when examination paper proposition; secondly increase the proportion of practice in the score; thirdly quantitative practice assessment score.

Examination Paper Proposition. In the early stage of the integrated teaching, the paper is mainly based on the knowledge of the subject, and increases the content of the other subjects, especially the knowledge points related to the practical link to promote the integration of the subject. In the long run, when the time is ripe, we can merge the two course examination into one piece of paper, increase the total score of the test paper, the proposition is mainly based on the examples, so that students really understand the relevant knowledge points.

Increase the Proportion of Practical Links. the total score of course assessment using the ‘6-3-1’model to calculate, that is, test scores accounted for 60% of the total score, practice scores accounted for 30% of the total score, the rest of the usual score accounted for 10% of the total

score. ‘6-3-1’ model fully takes into account the various aspects of the factors, especially the practical aspects, makes the students pay more and more attention to practical teaching, enhance practical ability, and to achieve the purpose of teaching reform.

Quantitative Practice Assessment Score. Practice as a representative of the practice has always been a lack of transparency of the assessment, make score randomness, individual students response greatly, and therefore it need to study the new practice assessment methods.

In the practical assessment, use the "Four Party scoring system", namely four links whitch are industry assessment score, score by teachers, practice team score, and practice team peers’ score, four links scores are used percentile, after scoring according to the proportion to equivalent ,it can be expressed by the Eq.1.

$$S = W \bullet a + T \bullet b + L \bullet c + M \bullet d \tag{1}$$

Type, S on behalf of the examination scores, W represents the industry assessment score, L represents the teem head’s evaluation, M represents team members’ evaluation, a, b, c, d, respectively on behalf of the proportion of each score in the total score of practice assessment, it should meet the requirements of $a + b + c + d = 1$.

Conclusions

Integrated teaching of ' Control Surveying' and 'GNSS principle ' change the single teaching mode, make the two related subjects teach, practice, assess synchronously .Practice has proved that the integrated teaching of the two courses on promoting teaching reform , improving teaching effect , enhancing the students’ hands-on ability, and improving students' professional quality has a good effect and this program is feasible in most of the colleges which set up surveying and mapping engineering as undergraduate course at present.

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