

On the Teaching Technical Innovation for Multimedia -Based Engineering “Method of Mathematical Physics”

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Abstract—Method of Mathematical Physics which has strong applicability is an important basic course in colleges of engineering. However, in the process of teaching this course, most teachers only focus on theoretical derivation, ignoring the practical application. This inappropriate teaching method greatly weakens the students' interest in learning, which hinders the improvement of students' ability to solve the practical problem. With the development of Multimedia and network technology, more and more teaching methods have been applied in class. As a discipline with strong application, “Method of Mathematical Physics” should be taught in a new way the modern technology is fully used. In this article, several ideals are discussed for the curriculum reform in terms of teaching content and teaching methods. We make a special mention of the innovation based of Network and Multimedia technology in this article. Combined with authors teaching practice, applied teaching methods are put forward.

Keywords- Method of Mathematical Physics; network; innovation; engineering; multimedia

I. INTRODUCTION

“Method of Mathematical Physics” is an important basic course in colleges of engineering. It plays a role in the nexus, which can not only consolidate the students' knowledge learned in higher mathematics course, but also provide a necessary mathematical foundation for the follow-up professional courses [1-3]. Furthermore, this course also contributes to training students' mathematical thinking and improving students' innovative ability and practical ability to solve a practical problem [4]. Combining Mathematics knowledge and automation electronics and other courses is the distinctive characteristics of this curriculum, with two parts included in this course---Functions of a Complex Variable and Integral Transforms. So it has both mathematical theory depth and strong applicability, the basic theory of which belongs to the category of analysis mathematics; while the application part connects with the areas about the control, information and electrical engineering disciplines. There is no doubt that this course is an important compulsory

course for electrical automation and other professional students. However, in the process of teaching this course, most teachers only focus on theoretical derivation, ignoring the practical application, and this inappropriate teaching method greatly weakens the students' interest in learning, which hinders the improvement students' innovation ability and the ability to solve the practical problem [4].

In recent years, information technology has developed by leaps and bounds. As the core of information technology, multimedia technology and network technology have impact on the entire education, which has led to not only the changes of teaching methods and means, but also the idea of education, thoughts, contents, theories and education modes. Integrating information technology and courses has become a breakthrough of the teaching reform. Mathematics teaching is the teaching of mathematical activity. The multimedia technology provides the mathematical activity with a teaching and learning platform, where teachers and students explore and study math problems dynamically. The fusion of the technology of multimedia and traditional teaching is mainly applying mathematical software or mathematics courseware in teaching. How does the multimedia technology blend in the traditional teaching to get better teaching effect? As a subject with strong application, Method of Mathematical Physics should be taught in a new way the modern technology is fully used. What we should do and how? Nowadays, some researchers have provided many reform ways on the course of engineering method of mathematical physics [5-7].

“Method of Mathematical Physics” covers many concepts, theorems, and the excises of it are difficult. But as a result of teaching reform on this course in colleges and universities, the class hours have been compressed again and again. How to finish the main contents of the course and improve students' passion for learning in the limited class hour, are the problems worthy to be discussed. My opinion is that we should think of the characteristics of the method of mathematical physics in teaching reform and make it more suitable for electronic communication engineering. According to my own teaching experience about this course over the years, I will talk about some teaching experiences in this article.

II. THE REFORM ON TEACHING CONTENT

Finishing everything about "Method of Mathematical Physics" in a short period of time is not realistic. So we must make some kind of trade-off of teaching content, selecting the important content, focusing on those practical parts, highlighting the characteristics of this course to solve practical problems, and making a more reasonable allocation for class. In our school, "Method of Mathematical Physics" is mainly for electrical, automatic control majors and so on, thus we can adjust the teaching content based on their needs, and make a professional selection.

A. Part of the processing on "Functions of a Complex Variable"

There are a lot of similar contents which have been learned in higher mathematics, so we can cut those overlapping parts, or reduce the class hours. Such as the concepts about limits, continuity, and derivative in complex function [1-2], which are all similar to those appeared in higher mathematics. When we teach these concepts, making comparisons is a good way which can help students to understand and save hours. Moreover, by comparing the old and new knowledge, students can experience the fun of applying knowledge and develop their innovation ability. Some jumbled theoretical proof, such as the proofs about formula of higher derivative, Taylor expansion theorem, can be completely discarded. In addition, the part of conformal mapping in the lessons also could be abandoned, because giving up this section does not affect the students' learning about subsequent course [4]. This conclusion was made by communicating with some professional teachers. For the content marked with an asterisk in the book, we also select those appropriate contents according to the professional characteristics of students. For example, we leave out the part about complex potential of the plane field (but for physics majors, this section should be focused on). Another example is logarithmic residue and argument principle part. These two parts have strong practicality. They are often used as research tools on the stability of the running system; therefore, we should take its teaching seriously.

Taking reasonable choices about the teaching contents can not only prevent the engineering students from spending too much time on the unimportant contents, but also arouse the students' interest in learning.

B. Part of the processing on "Integral Transforms"

The parts of "Fourier Transform" and "Laplace Transform" are important tools in the fields of electronic communications and signal processing, automatic control principle and circuit analysis [3]. We should provide a large number of examples to enrich the content of classroom, and teach students how to make a common signal spectrum analysis. Of course, the key point is that teachers should have a good understanding about this part of the professional knowledge, especially the Laplace transform which has very strong practicability. Using this method, a

function discussed in the time domain can be transformed to frequency domain, which makes the integral equations, differential equations and many practical circuit problems can be easily solved [3]. After clearing the theory, we can appropriately increase classes to add a lot of application-oriented examples combining with profession, emphasizing the combination of theory with practice. Meanwhile, we should make students recognize the important role of the course in their professional courses, improving their degree of importance of the course; fully mobilizing the students' interest. Eventually, it is beneficial to the improvement of teaching quality

III. THE REFORM ON TEACHING METHOD

A. Using computer software to calculate, improving the students' practical ability

The process of solving problem in Method of mathematical physics is relatively complicated. In one class, only a few questions can be resolved by the traditional teaching way. We spent most of the time on the calculation, while the thinking of the problem solving is seldom explained. This leads to low efficiency in class. Now computer computing power is very strong, in actual use, we can use some computer software to calculate, focus on interpretation of the mathematical methods, and teach students how to establish a mathematical model for practical problems.

B. Making full use of multimedia to assist teaching, improving the students' classroom participation

By using multimedia, teachers can display teaching content visually, making it become vivid, so as to enhance students' understanding of knowledge. The vivid image with unique sound, light and color can effectively create happy and harmonious situation, which stimulates students' positive emotion, and enhance students' interest in learning and motivation. For example, when we introduce the geometric meaning of derivative of complex function, students generally feel difficult to understand. But, if we use the multimedia technology, the curves images and the tangent vectors can be displayed dynamically. The difficulties are overcome easily.

C. Making full use of network resources to improve class efficiency

With the development and popularity of Internet technology, the relationship between people and network is getting closer. Using the network technology to build communication platform can achieve an effective communication between teachers and students. Through the communication, teachers can timely grasp the students' problem and study the basic situation, so as to adjust the class teaching.

On the other hand, as for the method of mathematical physics teaching, making full use of resources on the Internet can broaden students' horizons, arouse students' interest in learning and benefit our classroom teaching. There are a lot of teaching videos on the internet. We can

find some good teaching video clips from the Internet as teaching contents, screening them to the students in the classroom. The brand new teaching form is bound to promote the students' interest in learning.

In addition, the rapid development of micro class also provides a series of thought. We can choose a few points of knowledge to make into micro classes, and put them on the network, which makes students learn whenever and wherever possible.

D. *The combination of traditional teaching and discussion-based teaching*

In the past, teachers play the main role in teaching this course, while the students only listen passively. As a result, teachers and students have less communication. The latter has no real participation in classroom teaching and lacks initiative in learning. Therefore, we have to change the past "spoon-fed" teaching methods and turn to using heuristic discussion teaching. Having prepared carefully, teachers impart the knowledge and skills to students in the good way that students are willing to accept. Here is an example. When we talk about some content, we should try to put forward the problem situation and encourage students to participate actively and think independently. Even if the students can't answer the question accurately, we have to give full play to the leading role of students and encourage them to express their ideas about the problem, without ruining their enthusiasm. Classroom teaching practice has proved that the combination of traditional teaching and discussion-based teaching, to a certain extent, can not only improve students' interest in learning the course but the quality of classroom teaching.

E. *The combination of classroom teaching and extracurricular inquiry teaching*

Considering the close relationship between "Method of Mathematical Physics" and major course, we can take in-class teaching combined with extracurricular inquiry in addition to using a combination of traditional teaching and discussion-based teaching [8]. The subject of "Method of Mathematical Physics" is suitable for extracurricular inquiry. It was the way that we used in the class, such as the part of integral transform with strong applicability. We first divided students into several groups, and then gave each team a proposed research topic. The issue may be an application in professional course for Method of Mathematical Physics, or a learning summary. After class, students check data and refer to the information about their chosen subject, and then form a textual. Finally, the teacher chooses a few groups who have done a good job to show their research results by using PowerPoint. The fact has proved that this teaching method has been accepted by students. They can actively participate in the group activities, searching for information about the topic carefully and listening to other students attentively. In the eyes of students, targeted research makes the application on "Method of Mathematical Physics" more specific in the subsequent courses. Practice indicates that the initiative open teaching way expands the space of classroom teaching.

Moreover, this new teaching way which is more effective than the traditional ones can mobilize students' interest in learning, improve students' understanding of knowledge, and cultivate students' ability to apply knowledge to solve practical problems.

IV. THE REFORM ON ASSESSMENT METHOD

In the old assessment program of our school, the final results consist of two parts, the homework score and the final exam score. This single assessment method can not well indicate students' ability of creating and applying knowledge to solve problem. Therefore, on the basis of the reform on teaching method, we also have made a reform to the mode of examination. In addition to the final exam, assessment results can also be combined with students' performance in writing reports and participating in researches and class discussion. That is to say, it is a comprehensive evaluation. The final result is composed of three parts: normal performance (15%), homework (15%), and the final question paper grades (70%). The diversity of the evaluation way not only aroused the enthusiasm of the students at ordinary times, but also promoted the students' innovative thinking.

Our teaching aims are to cultivate students' creation ability as well as thinking ability and teach them to be proficient in applying mathematical tools to solve problems. Any educational reform should center on this goal.

V. CONCLUSION

Points above are author's teaching reform ideas about "Method of Mathematical Physics". Multimedia and network technology provides effective tools to improve the class teaching effect. Combining the traditional teaching media and modern teaching media, giving full play to their respective functions, can optimize the classroom structure, and improve the quality of classroom teaching.

Applying multimedia and network technology to teaching the course of "Method of Mathematical Physics" not only can enhance students' interests in learning, stimulating their learning motivation, providing sensing material, improving exercise intensity, but also optimize teaching process. Practice has shown that students can grasp the basic knowledge and skills easily in the limited hours when we take a variety of teaching methods and means, which have further improved the quality of classroom teaching.

It is undoubted that applications of a kind of teaching technology have its obvious advantages; however, the disadvantages also should not be ignored. In the teaching "Method of Mathematical Physics", we should pay attention to the following questions: Multimedia and network technology can only be used as the means of teaching, but should not be used as the purpose of teaching. Only using the modern technology in a reasonable way can we improve the efficiency of classroom teaching.

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REFERENCES

- [1]. K.M. Liang. "Method of Mathematical Physics", 3rd ed., Beijing: Higher Education Press, 1998.
- [2]. D.R.Guo. "Method of Mathematical Physics", Beijing: Higher Education Press, 1991.2:1-10.
- [3]. G.G.Liu and M.Q.Liu. "Reform and Exploration of teaching contents on the Method of Mathematical Physics" University physics, Beijing, 24 vol. 2004, pp.58-62.
- [4]. Y.Z.Wang., L.Y.Lv., X.H.Xiang and Z.J.Liu. "Application of complex variable function and integral transform" Xuzhou: CUMT press, 2014.
- [5]. T.C.Xu. , Y.L.Gu. and L.Qian. "Signal and system", 3rd ed., Beijing: Electronic industry press, 2008.
- [6]. Xi 'an Jiaotong university, "Functions of complex variable", 4th ed., Beijing: Higher Education Press, 1996.
- [7]. Y.L.Zhang. "Integral Transforms", 4th ed., Beijing: Higher Education Press, 2003.
- [8]. L.Y.Lv., and L.Q.ZHU. "Teaching Reform of 'Method of Mathematical Physics' on the Background of Application", Journal of university of Jinan, Social Science Edition, Jinan, vol.21, Nov. 2011, pp.105-106.