

## Research on the Application of Internet in the Biomedical Materials Course

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### Abstract

**With the popularity of the Internet, the traditional teaching methods cannot meet the demand of University talents. "Biomaterials", a typical interdisciplinary course, is difficult to be given by traditional teaching methods, and is hard to draw attentions of students. This paper will, take the advantages of typical Massive Open Online Courses (MOOC) and other online classroom teaching methods, reasonably design the course basing on the characteristics of the course and achieve better teaching results on "biomaterials" by combining online and offline teaching and learning.**

### Keywords

**Massive Open Online Courses, Flipped classroom, Biomedical materials.**

### 1. Introduction

With the advent of the knowledge economy era, the social demand for increasingly innovative talents, colleges and universities charged with the task of building the country to cultivate talents. In recent years, with the popularity of the Internet, the rapid development of Internet devices, making more and more students to have access to more new knowledge via the internet. In the new situation, the traditional teaching methods can not meet the needs of innovative college talents reform and innovation of college classroom teaching mode has become an inevitable trend.

Biomedical materials, refers to the physiological disorder diagnosis, treatment, repair, or replace biological tissues or organs, enhance or restore its function of special functional materials. It is a typical cross-disciplinary involving materials science, medicine, life sciences and has a broad and fast updating knowledge base. "Biomedical Materials" is the main course in biomedical engineering. The course combines the basic principles and cutting-edge development of biomaterials. It introduces the research methods and results of biomedical materials, including biomedical inorganic materials, metallic materials, polymers, composite materials, nano-materials, tissue engineering related materials, biomimetic materials, drug delivery systems, diagnostic and interventional materials and recent advances of biological materials security, reflecting the interdisciplinary nature of biological materials.

As a typical interdisciplinary curriculum, "Biomedical Materials" is not easy to be taught. Firstly, the curriculum covers a wide range of knowledge, it is difficult to give a comprehensive and systematic in-depth description of each subject in the limited class time. It easily leads to cramming method of teaching so that students can not understand in a short time and impact the following study. Secondly, the knowledge of the course updates quickly, new research emerging, which requires the instructor invest more time and energy to understand learning and development in various disciplines, to be able to lead the forefront of interdisciplinary students to recognize knowledge and innovative thinking. It also requires students to actively retrieve relevant information and can be interactively involved in the whole process of teaching the course. Finally, the lack of innovative teaching methods, the use of instructor-led preaching traditional teaching mode, makes a boring teaching process and less effective.

[1]

## 2. Application of the Internet in the class Design

“Internet + education” simply is to make all teaching activities being centered around the Internet. Teachers and students should teach, learn and interact via internet. Make offline activities as a complement to the online activities. Currently using the Internet for teaching modes include MOOC and flipped classroom lessons.

### 2.1 MOOC

Massive Open Online Courses (MOOC) is an open teaching Method which take advantage of the information network and the big data mining functions. Here, the "open" contains three meanings: First, course open to the public, curriculum learners registered objects without geographical, school and other restrictions. Second, course open content and process of teaching content and processes are based on the needs of learners achieve online dynamic adjustment and expansion; Third, the open relationship between "teaching" and "learning", that in the process of teaching the role of teachers and students the course can be changed. [2] Due to the overcoming of the constraints of time existing in the traditional courses, enrollments of MOOC may be in the hundreds of thousands, "massive" distinctive characteristics.

Laura Pappano, an author of "The New York Times" said, 2012 is "the year of MOOC". Although the history of MOOC development is not long, it attracted great attention in a very short period, and has the potential of promoting the reform of higher education and even subvert the entire tradition. In the "2013 International Forum on Higher Education (Ningbo)", Qu Zhenyuan, president of the Chinese Association of Higher Education said, "low levels of education will eventually be substituted by MOOCs. Facing the sudden emergence of MOOC, our classroom and teaching methods must be reformed!" Natebimu Dunne, vice-chancellor of University of Southampton, said: "Those who do not accept the MOOC are dead, universities must embrace massive open online courses of action, and to adapt their teaching methods, or face a difficult future." An article on "National Interest" have even predicted, "MOOCs will subvert the existing higher education in the coming decades, more than half of four thousand universities in the United States would result in the disappearance." [3]

MOOCs which provide people access to high quality and low cost teaching resources are challenging the traditional university education which needs to pay expensive tuition fees. At the same time, MOOCs will encourage professors to increase investment in energy and study the learning pattern of students, hence, teaching quality will be guaranteed. As "biomaterials" course covering a wide range of knowledge, quick knowledge update and other characteristics, it can be used to implement the combination of Internet and traditional teaching mode. In this course, there are more content to those basics, such as polymer materials, metal materials, inorganic non-metallic materials, basic knowledge of these disciplines relates to broader, including physics, mechanics, physiology, anatomy and so on. It is not possible to conduct a full complement of various disciplines involved, therefore, MOOC allows students to use the Internet to learn the course in advance or synchronous learning. There are many MOOC programs of the basic subjects available online which are given by globally recognized professors. Students can use after class time to learn, which allows students in the class will be involved learning content systematically. At the same time, we can combine the characteristics of the culture of the students, such as the medical polymer material or a metal material (such as magnesium alloys, titanium alloys) Basic characteristics and clinical application of video content to create MOOC, professors through online record video completion of the course the basic content of the lecture, students use the time to learn the next lesson. Online teaching and learning system enables students to grasp more comprehensive knowledge points of biomedical materials.

### 2.2 Flipped classroom

The so-called flipped classroom is to change the traditional student acceptance and understanding methods of knowledge, the teacher play instructional videos before class, to enable students to acquire knowledge through video in the classroom. Students explore organizational problems encountered in the class. Teachers play a guiding role and assist in the teaching process, and

ultimately enable students to understand the new knowledge learned. Flipped classroom and the traditional teaching model comparison, has great advantages, mainly in four aspects. First, the content of classroom teaching reproducible; second, strong interact between students and teachers in process of teaching; third, bringing new classroom experience to students; fourth, enable students to focus their attention on classroom learning.

Flipped classroom teaching model is to enable students to become the protagonist of the classroom. Students complete the required background knowledge before classes. Different from the traditional classroom teaching method, in flipped classroom, students carry out knowledge learning online, and interact with teachers, such as answering questions, exchange of experiences and other knowledge application, offline. Teachers can have more time to communicate with everyone, which makes the status and role of teachers and students in teaching fundamental change, from teachers who teach into inspirer, and student from passive knowledge recipients into active learners. The main function of classroom learning is no longer knowledge learning, but evaluate, exchange and interaction.

Flipped classroom is the most effective way to enhance students' self-learning ability. For biomedical materials which involves a wide range of knowledge, students can access to a lot of knowledge off-class, and classroom communication, discussion sessions allow students to learn the personal information passed to more students through discussions and exchange of teachers and students, and ultimately achieve better learning outcomes. For example, the content of surface modification of medical stainless steel, medical polymer materials research and other anti-clotting, can use flipped classroom approach to implementation. By the off-class learning, allowing students to master basic modification methods and enable students to use the Internet to broaden their thinking, more comprehensive understanding of the part. At the same time, individual student will have different views on certain harvesting and knowledge in the classroom after the exchange of the respective acquired useful information to communicate, discuss, and learn from each other by a teacher summary, further to better grasp the parts, and eventually achieve better learning results.

### **3. Internet applications in the design of homework**

With the advent of the Internet age, students can use the Internet to access vast amounts of information, however, it is particularly important to guide students on how to organize the collected information. In the "Biomedical Materials" course, because the course knowledge is more dispersed, how to design homework, through job training to enable students to apply the material or a material system becomes a problem now facing teachers. At the same time, how to encourage the students learning enthusiasm after class is also very important.

In the class design process, you can take medical products as a carrier. Take a certain kind of medical products (eg, vascular stents, heart valves, etc.) as an example to let students to use the Internet, access to the specific materials used in products which, for each material have what performance characteristics, advantages and disadvantages, what aspects It needs to be improved, the material can be used for any other medical products. The above problems are arranged sequentially and gradually go through this progressive job arrangement, let students use class time under the phased completion of the job, re-use classroom discussions and exchange, to achieve a better after-school learning.

### **4. Conclusion**

According to "biomaterials" course covering a wide range of knowledge, update their knowledge and fast characteristics to be used to implement curriculum taught to work the Internet and traditional teaching mode combination. Based MOOC professors objects and teaching content distributed nature, teaching the freedom and flexibility and other characteristics, it can be a medical material base areas and medical materials basics, that deals with Mu class video way to expand the use of network resources, so that students online Learn. For research trends and research focus of some specific material like cutting-edge knowledge can be used to expand the flipped classroom, students use video courseware initiative to complete self-study, part of the learning content in the form of tasks

arrangement to students, fully mobilize students to participate the enthusiasm, the use of role reversal achieve flipped classroom, so that students in the classroom lectures from passive to active to ask questions.

In short, MOOCs allow students to have an overall knowledge of course content system, and flipped classroom can help students master basic content and development trend of medical materials, based on some of the details of a particular field or have more in-depth study. Using this approach allows students have a comprehensive understanding of the material, based on the knowledge of a number of key requirements to master the details. Meanwhile, the after class work, based on the in-depth study of basis, enables students to use the Internet to complete the related work.

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