

# The Application of Virtual Simulation Technology in Macroeconomics Course

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**Abstract:** Under the environment of the rapid development of network science and technology, the application of virtual simulation technology in college experiment teaching has become a new direction of teaching reform. In recent years, virtual simulation technology has been well used in the experimental teaching of many science and technology subjects, but in the experimental teaching of humanities and social disciplines, especially economic management disciplines, the application of virtual simulation technology still needs to be developed and strengthened. According to the characteristics of the economic management compulsory subject Macroeconomics teaching, this paper discusses the teaching advantages of using virtual simulation technology and explores how to introduce virtual simulation technology into the experimental teaching of macroeconomics. This promotes the application of virtual simulation technology in the experimental course of “macroeconomics” from the two aspects of strengthening the support and management of the school and strengthening the cooperation with all forms of life, constantly improve the experimental teaching quality of the course, and provide beneficial practical exploration for the experimental teaching of economic management subjects.

**Keywords:** Virtual simulation technology; Experimental teaching; Macroeconomics

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## 1. Introduction

In the context of the rapid development of network science and technology, with the increasing maturity of virtual simulation technology, introducing virtual simulation technology into experimental teaching has become a new direction of teaching reform in colleges and universities<sup>[1]</sup>. The Ministry of Education first proposed the concept of “golden lessons” in 2018 and listed the virtual simulation experiment project as one of the five “golden lessons” to highlight the importance of virtual simulation in teaching<sup>[2]</sup>. Further, the document “Implementation Opinions of the Ministry of Education on the Construction of First-class Undergraduate Courses” issued by the Ministry of Education in 2019 once again emphasized the importance of the construction of first-class courses in virtual simulation experiment teaching in colleges and universities, advocating the deep integration of information technology and education and teaching<sup>[3]</sup>. The promulgation of these policies has provided guidance and support for the promotion of virtual simulation experiment teaching and promoted the innovation and reform

of college teaching. Virtual simulation technology has been well used in many science and engineering subject experiment courses, but in the field of humanities and social sciences, especially economics subject experiment courses, the application of virtual simulation technology is still to be developed. Macroeconomics, as a core professional course of economics majors in economic management colleges, is usually carried out in the form of theoretical teaching combined with experimental teaching. The course is generally characterized by multiple concepts, multiple models, highly abstract, and limited time and space, which leads to many difficulties in the experimental teaching of the course<sup>[4]</sup>. In the view of this situation, by discussing the advantages of virtual simulation, this paper further considers how to apply virtual simulation technology in the experimental teaching of macroeconomics to conduct beneficial exploration on the experimental teaching of humanities and social subjects, especially economic management subjects.

## **2. The advantages of virtual simulation in the experimental teaching of Macroeconomics**

Traditional macroeconomics has met unprecedented challenges. As a traditional subject closely related to social practice, macroeconomics has its characteristics and new problems in experimental teaching. The introduction of virtual simulation technology can effectively play the advantage of virtual simulation in experimental teaching.

### **2.1. Virtual simulation technology enhances the ability of Macroeconomics experiment teaching to explain reality**

First, due to the complex economic relations involved in the real macroeconomic system, numerous influencing factors, and irreversible economic operation process, traditional experimental teaching techniques and methods cannot completely replicate the operation process of the macroeconomic system and its intricate economic relations and are relatively limited in coping with the complex and changeable characteristics of the macroeconomic economy. Second, the traditional experimental teaching mainly adopts the empirical research method of observing economic data, which cannot deeply understand the micro-mechanism in the process of economic operation, thus reducing the explanatory power and forecasting ability of the operation of macroeconomic system<sup>[5]</sup>.

The advantage of introducing virtual simulation technology into macroeconomic experiment teaching lies in building simulated macroeconomic systems through software and programs, replicating the essential process occurring in actual economic operation, and studying the existing or designed system through simulation experiments and concluding, which can enhance the effect of linking theory with practice in experimental teaching to a certain extent, enhancing the ability to explain the macroeconomic reality.

### **2.2. Virtual simulation technology enriches the experimental teaching methods of Macroeconomics**

Facts have proved that virtual simulation is a particularly effective means of research. The main tool of virtual simulation is a computer, and the research process includes two main steps establishing a virtual simulation model and conducting a virtual simulation experiment<sup>[6]</sup>. Therefore, virtual simulation is also an experimental technology, which is essentially different from the traditional research method of numerical calculation. In fact, economic simulation is to use of computer software to simulate some economic activities, and then according to the corresponding model algorithm formed by some economic theory, after the simulation reaches a stable

state, try to compare the stable state with some conclusions in economics, and then supplement the economic experiment and economic theory. It is possible to obtain the research conclusions of the economic model and determine the information structure <sup>[7]</sup>.

### **2.3. Virtual simulation effectively improves the level of macroeconomic experiment teaching**

The rise of virtual simulation technology brings human-computer interaction into a new field of development and opens up new research. Virtual simulation can make use of virtual simulation platforms and various virtual simulation software, adopt different types of simulation means to teach, and improve the level of experimental teaching. Virtual simulation technology provides a new display method for the visualization of massive data in various fields, so virtual simulation can realize the effective integration, optimization and contribution of curriculum teaching resources within the major, which is convenient for experimental teaching to break the limitation of time and space, expand the depth and breadth of experimental teaching content, and improve the level of experimental teaching.

## **3. The application of virtual simulation in the experimental teaching of Macroeconomics**

Based on the incomparable advantages of virtual simulation technology in the experimental teaching of Macroeconomics, it is particularly necessary to introduce virtual simulation into the experimental teaching of macroeconomics. The problem lies in ways to better develop and utilize the virtual simulation technology needed to carry on comprehensive and systematic thinking.

### **3.1. Characteristics of the application of virtual simulation technology in Macroeconomic**

#### **3.1.1. Update the thought of experiment teaching**

The application of virtual simulation technology in the experimental teaching of macroeconomics needs to rethink the teaching ideas. Under the background that the socio-economic development demands more macroeconomic analysis ability of economic management talents, the experimental teaching ideas should continuously improve students' macro-economic analysis ability as the basic teaching goal and fully rely on science and technology such as virtual simulation, human-computer interaction, database and multimedia. Systematically build a virtual simulation macroeconomic comprehensive experiment project platform integrating experimental teaching, practical training, scientific research and social services to continuously improve the level of experimental teaching, strengthen students' understanding of macroeconomic theories and improve their ability to recognize economic laws.

#### **3.1.2. Improve the standards of experimental teaching construction**

As one of the five "gold courses," the construction standard of a virtual simulation experiment course should refer to the "gender one" gold course standard proposed by Wu Yan, Director General of the Department of Higher Education of the Ministry of Education <sup>[8]</sup>. "Gender one degree," that is, high order, innovation and challenge <sup>[9]</sup>. First, the design of experimental projects must organically integrate knowledge, ability and quality to cultivate students' comprehensive ability and advanced thinking to understand and analyze complex macroeconomic issues. Second, the construction of the experimental project course content should highlight the cutting-edge

and contemporary characteristics of the macroeconomy, and make full use of the advancement and interaction of virtual simulation technology to increase the inquiry and personalization of the experimental course, to meet the “innovative” standard requirements of the construction of gold course. Third, the use of virtual simulation to increase the difficulty of the experiment, setting the annual economic activities and tasks of different virtual objects, develop and purchase software operating systems to achieve real-time interactive feedback of teaching content and experimental data results between teachers and students, complete various experimental teaching work such as teaching organization and management, and put forward higher requirements for teachers to prepare lessons and students after class. According to this standard, the construction of a Macroeconomics teaching virtual simulation experiment project system and the creation of a macroeconomics virtual simulation experiment teaching “golden lesson” will greatly improve the gold content of experimental teaching and truly achieve the deep integration of information technology and intelligent technology with education and teaching<sup>[10]</sup>.

### **3.1.3. Reform the experimental teaching system**

To use virtual simulation in the experimental teaching of macroeconomics, the original single traditional experimental teaching system must be broken. To build an experimental teaching system with macroeconomics as the core, multi-level structure and cross-disciplinary fields highlight the advantages of virtual simulation in improving experimental teaching level and integrating experimental teaching resources, realize the full sharing and integration of various high-quality resources in different disciplines, and use virtual simulation technology to introduce various scientific research results and methods into the teaching field to enhance the strength and influence of economics.

## **3.2. The construction of macroeconomic virtual simulation experiment project courses based on gold course standards**

The aim of experimental teaching is each specific experimental project, and the level of experimental project construction determines the level and effect of experimental teaching. The construction of a macroeconomic virtual simulation experiment teaching project course based on the gold course standard is to carry out in-depth teaching reform of the experiment course under higher requirements.

### **3.2.1. Develop the golden course of the macroeconomic virtual simulation experiment**

According to the “gender one-degree” standard of the Ministry of Education, developing and constructing the gold course of virtual simulation experiment teaching macroeconomics is a pioneering idea to introduce virtual simulation technology into the course experiment. According to the essential elements of the construction of the golden course, the macro-economy virtual simulation experiment project is carefully designed, in line with the principle of “can be real, not false,” to explore the expansion and extension of the virtual simulation experiment in the specific teaching application to the traditional experiment teaching. The experiment project creates a real macroeconomic environment through a virtual simulation of the macroeconomic system, simulating the management process of the government and the microeconomic main body. The degree of simulation of the project should focus on the real restoration of the core simulation elements: The economic principles of the economic behavior and results of the game between the government, manufacturers and consumers, so that students can more directly understand the operation process and results of the whole macroeconomic society, master the core theories of macroeconomics and the teaching requirements of its application, and strive to develop the experimental teaching in the direction of advanced, innovative and challenging.

### **3.2.2. Construction of macroeconomic virtual simulation experiment project content system**

The construction of a macroeconomics virtual simulation experiment project system is not to completely overthrow the existing experimental project system but to break the original single traditional experimental teaching discipline boundaries and create an experimental teaching project system with macroeconomics as the core, multi-level structure and cross-disciplinary fields. Virtual simulation technology is used to introduce all kinds of scientific research results and methods into the teaching field and realize the full sharing and integration of all kinds of high-quality resources in different disciplines. The construction of a macroeconomic virtual simulation experiment project system can divide the setting of macroeconomic experiment projects into three levels, namely basic level, thematic level and innovative research level. Different types of experiments are related to each other and show a hierarchical progressive relationship, and try to introduce virtual simulation technology into experimental projects at each level.

#### **3.2.2.1. Basic experiment**

Basic experiments include theoretical knowledge and basic experiments of macroeconomics in class. In teaching, modern information network teaching means can be used to present realistic macroeconomic phenomena and problems to students and enhance their perceptual understanding of macroeconomics. The method of combining case analysis and practical analysis is adopted to teach students basic techniques and thinking methods of macroeconomic analysis. Analysis and solution of practical problems were applied so that students can experience the application of macroeconomic theory in real economic life.

#### **3.2.2.2. Experiments on special topics**

Thematic experiments are the deepening and expansion of basic experiments, which can set up several thematic experiments involving investment, consumption, import and export, industrial development, national income and employment, prices, social development, macroeconomic policies, and other fields in the macroeconomy. In the course of the experiment, the macroeconomic model related to the topic is combined with virtual simulation to show the core elements of each topic more comprehensively, the core elements are the virtual set, the virtual simulation environment and the teaching content of the experimental teaching are constructed, and the operation and analysis of the virtual simulation special experiment are carried out, aiming at improving the students' cognition of the macro-economic theory of the topic to improve students' ability of independent learning and problem analysis <sup>[11]</sup>.

#### **3.2.2.3. Innovate research-type experiments**

Innovative research experiments include not only experimental projects of a research nature but also comprehensive experiments of competition, extra-curricular practice and exchange activities. Corresponding virtual simulation platforms can be built to provide students with abundant optional experiment content, teaching resources, competition simulation and extra-curricular practice exchange space <sup>[12]</sup>. Research experiment projects can comprehensively utilize the latest network technology such as virtual simulation, big data and cloud platforms, and use computer simulation software to change the virtual reality of the macroeconomic system by changing the parameters of the economic system, to obtain different research conclusions, which fully reflects the complexity and variability of the curriculum experiment content. The experiment can improve students' innovation ability and research ability. Based on the completion of basic experiments and special experiments, students can independently choose higher levels of innovative research experiments to obtain higher scores,

change passive learning to active learning, change from solo to team cooperation, and form a good atmosphere for mutual learning, communication and sharing.

### **3.2.3. Set up a comprehensive laboratory of macroeconomics**

Through the continuous construction of the experimental teaching system of macroeconomics, the goal of building a comprehensive laboratory of macroeconomics will eventually be realized. The comprehensive laboratory will start from the needs of economic discipline development, personnel training, scientific research and innovation, integrate the experimental and training resources of theoretical economics and applied economics, use new technologies including virtual simulation, the combination of science and practice, data integration, integrate the required hardware and software facilities, and build an advanced professional innovative service system through modern IT technology<sup>[13]</sup>. To build a comprehensive laboratory of macroeconomics, it is important to realize the combination of virtual and real teaching and the integration and sharing of teaching information, and strive to build a comprehensive laboratory of macroeconomics with a new concept on the intelligent integrated information platform.

## **4. Suggestions on the application of virtual simulation technology in the experimental teaching of macroeconomics**

To better apply and promote virtual simulation technology in the experimental teaching of macroeconomics, whether it is the development and construction of the “golden course” of virtual simulation teaching of macroeconomics or the construction of a comprehensive laboratory of macroeconomics, it cannot be completed only by the strength of the teaching department, but also the escort of schools and enterprises, to speed up the construction of virtual simulation experimental system of macroeconomics. This constantly promotes the application and promotion of virtual simulation technology in the experimental teaching of economic management subjects.

### **4.1. Strengthening the support and management of the school**

In order to strengthen the school's support and management of virtual simulation experiment teaching, the following measures can be used for reference.

- (1) Establish a special teaching support team, including teachers, technicians and instructional designers, to jointly take charge of the planning, design and implementation of virtual simulation experiment teaching<sup>[14]</sup>;
- (2) Make full use of existing teaching resources and facilities to provide necessary hardware equipment and software platform for virtual simulation experiment teaching;
- (3) Strengthen teacher training and professional development to improve teachers' understanding and ability of teaching concept and technology application in virtual simulation experiment teaching;
- (4) Improve the teacher evaluation and encouragement mechanism, through the teaching quality evaluation and reward system, encourage teachers to actively participate in the practice and research of virtual simulation experiment teaching;
- (5) Coordinate experimental projects and teaching contents at the school level, coordinate the sharing of experimental data of on-campus courses and cross-specialty comprehensive virtual simulation experiment data, promote the collaborative innovation of virtual simulation experiment teaching between schools and the open sharing of teaching resources of virtual simulation experiment between schools<sup>[15]</sup>;

- (6) Strengthen management and supervision, and establish a sound virtual simulation experiment teaching quality assurance system, to ensure the accuracy of teaching content and the effectiveness of the teaching process.

## **4.2. Actively strengthen cooperation with all sectors of society**

The application of virtual simulation technology requires cooperation among teachers, universities and enterprises to form a stable multi-dimensional cooperative relationship with all parties. First of all, all parties need to jointly research and develop technical architecture and core technologies, and establish a collaborative mechanism of open sharing of experimental technologies and resources. Moreover, the requirements of experiment-related network conditions and the design of laboratory simulation working environments also need the assistance of enterprises. Secondly, the laboratory will expand value-added services with industry-exclusive laboratories, integrate the superior resources of academia and the business community, and provide a broad platform for communication and cooperation between teachers and students. Thirdly, the experimental teaching of the comprehensive laboratory of macroeconomics needs to cooperate with the government and enterprises, build an off-campus practice teaching base and professional practice base, build an economics simulation experiment platform with brother colleges and universities, carry out talent co-education, exchange and cooperation and collaborative development, and jointly explore the symbiotic mechanism of multi-interaction of teaching practice of economic management majors.

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