



# Practice and Exploration of Virtual Simulation Experimental Teaching of Economics in the Military Academies

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**Abstract.** This paper makes an empirical analysis of the teaching effect of virtual simulation experiments of economics in a military academy. It is found that the virtual simulation experiments of economics do have good teaching effect, but the factors such as laboratory environment, system convenience, experiment design, experiment organization and management affect students' attitude evaluation and willingness to use, which weakens the teaching effect. Based on this, the military academies should increase the investment in the laboratory hardware facilities, cooperate with local universities and colleges to develop experimental teaching software system, choose experimental teaching content rationally, optimize experiment design continuously, and improve teachers' experimental teaching ability greatly.

**Keywords:** Virtual simulation · Experimental teaching · Economics · Military academies

## 1 Introduction

In the recent years, virtual simulation experimental teaching, which is supported by technologies such as virtual reality, multimedia, human-computer interaction, database and network communication, has developed rapidly and become the key content of teaching reform in the universities and colleges.

In 2018, we introduced the “Comprehensive Simulation Experimental System of Western Economics” from Chengdu Jiekeli Technology Co., LTD. Relying on the Economics Laboratory, we started virtual simulation experiments of economics in the undergraduate teaching in 2019, which achieved certain teaching effects, but also found some problems. This paper intends to make an empirical analysis of the teaching effect of virtual simulation experiments of economics in our school, so as to explore the direction and approach of the reform of virtual simulation experimental teaching of economics in the military academies.

## 2 An Empirical Analysis of the Teaching Effect of Virtual Simulation Experiments of Economics in a Military Academy

The ultimate goal of teaching is to help students acquire knowledge, cultivate ability and improve quality. Students' learning experience and ultimate results are the important basis to judge the teaching effect [1]. This paper mainly establishes a research framework for teaching effect of virtual simulation experiments of economics from the perspective of students.

### 2.1 Data Sources

In the spring semester of 2022, 210 sophomores take part in the course "Fundamentals of Economics", with a total of 70 class hours, including 64 class hours for theoretical teaching and 6 class hours for experimental teaching. The experimental teaching is arranged at the end of the semester, relying on the Economic Laboratory and using "Comprehensive Simulation Experimental System of Western Economics". After the course was completed, we sent out electronic questionnaires about the teaching effect of comprehensive simulation experiments to these students through "Questionnaire Star". A total of 201 questionnaires were collected, and 198 were valid, with an effective rate of 94.29%.

### 2.2 Questionnaire Design and Variables Description

Based on the existing research results and the characteristics of this course, we designed nine variables in the questionnaire from the perspective of students to measure the teaching effect of virtual simulation experiments of economics (as shown in Table 1).

The laboratory environment refers to the hardware facilities of experiments, which is an important factor affecting students' experimental experience and satisfaction. It is measured by three indicators. The system convenience refers to the software system of experiments, which is also an important factor affecting students' experimental experience. It is measured by two indicators. The experiment design also refers to the software system of experiments, which is the main factor affecting students' knowledge acquisition, ability cultivation and quality improvement. The following five indicators are set to measure it. The experiment organization and management refers to the role of teachers in the experiments, which is not only an important factor affecting students' experimental experience, but also an important factor affecting students' knowledge acquisition, ability cultivation and quality improvement. It is measured by four indicators. The knowledge acquisition, ability cultivation and quality improvement are the main variables which measure the teaching effect of virtual simulation experiment of economics. The attitude evaluation and willingness to use refer to students' overall feelings towards the virtual simulation experimental teaching of economics. They are measured by three indicators respectively. The relationship between the variables is shown in Fig. 1.

There are 9 variables and 29 indicators in the questionnaire. Each indicator is evaluated by Likert 7-level scale, with 7 points indicating "extremely favorable" and 1 point indicating "extremely unfavorable" [2].

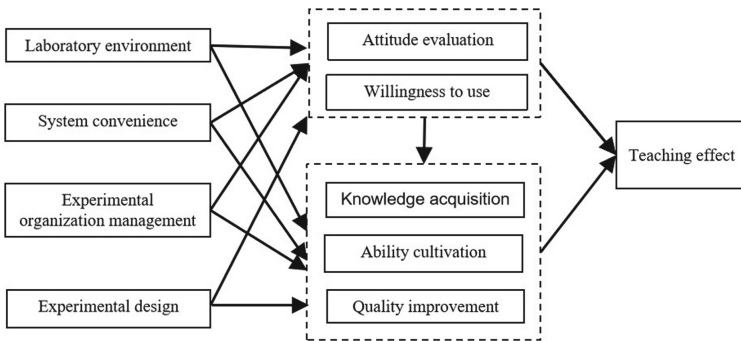
**Table 1.** Evaluation Variables and Indicators of the Teaching Effect of Virtual Simulation Experiments of Economics

Variable	Index	Meaning
Laboratory environment	E1	The laboratory equipment is complete
	E2	The laboratory equipment is relatively new
	E3	The laboratory equipment runs efficiently
System convenience	C1	The virtual simulation experimental system of economics is easy to operate
	C2	Be able to master the operation process of the virtual simulation experimental system of economics quickly
Experiment design	D1	The experiment content is reasonable
	D2	The experiment rules are reasonable
	D3	The number of experiment samples is reasonable
	D4	The experiment process is clear
	D5	The experiment results are stable
Experiment organization and management	OM1	The experiment site is orderly
	OM2	The teacher gave timely guidance during the experiment process
	OM3	The teacher guided students to discuss during the experiment process
	OM4	The teacher made a summary and comment in time after the experiment
Knowledge acquisition	K1	These experiments helped me deepen my understanding of the economics knowledge
	K2	Learned new knowledge from the experiments
Ability cultivation	A1	These experiments have enhanced my practical ability
	A2	These experiments have enhanced my ability to analyze and solve problems
	A3	These experiments have enhanced my creative ability
	A4	These experiments have enhanced my teamwork ability

*(continued)*

**Table 1.** (continued)

Variable	Index	Meaning
Quality improvement	Q1	These experiments have stimulated my interest in studying economics
	Q2	These experiments have improved my economics literacy
	Q3	These experiments have strengthened my sense of duty
Attitude evaluation	AT1	Be satisfied with the virtual simulation experimental teaching of economics
	AT2	The teaching hours of virtual simulation experiments of economics should be increased
	AT3	The virtual simulation experimental teaching of economics needs improvement
Willingness to use	I1	Willing to use virtual simulation experimental system of economics
	I2	Prepare to continue practicing after class
	I3	Plan to team up against other teams



**Fig. 1.** Research Framework for Teaching Effect of Virtual Simulation Experiments of Economics

**2.3 Reliability and Validity Test**

In order to ensure the quality of the questionnaire, the reliability and validity of all variables are tested through SPSS22.0. Cronbach’s a coefficient is mainly used for reliability analysis to ensure the internal consistency of variables. KMO test and Bartlett spherical test are used for structural validity analysis to ensure the correlation between variables. The results are shown in Table 2.

**Table 2.** Reliability and Validity of Variables

Variable	Number of questions	Cronbach's a coefficient	Extraction factor	KMO test	Bartlett sphericity test significance	Cumulative variance ratio (%)
Laboratory environment	3	0.826	1	0.723	0.000	71.398
System convenience	2	0.847	1	0.798	0.000	80.456
Experiment design	5	0.918	1	0.835	0.000	85.357
Experiment organization and management	4	0.894	1	0.807	0.000	79.534
Knowledge acquisition	2	0.901	1	0.839	0.000	83.203
Ability cultivation	4	0.932	1	0.872	0.000	87.235
Quality improvement	3	0.927	1	0.869	0.000	81.396
Attitude evaluation	3	0.847	1	0.776	0.000	75.235
Willingness to use	3	0.883	1	0.795	0.000	73.497

According to Table 2, Cronbach's a values of all variables are above 0.8, indicating that each variable has a high internal consistency and strong reliability. The KMO values of all variables are above 0.7, and the significance of Bartlett sphericity test is 0.000, indicating that the correlation between variables is strong and the questionnaire structure is well designed.

## 2.4 Data Analysis

The AMOS22.0 is used to test the research model, and the results are shown in Table 3.

By comparing the regression coefficients, it can be seen that among the variables affecting the attitude evaluation and willingness to use, the experiment design has the greatest influence, followed by the convenience of the system and laboratory environment, and the experiment organization and management has the least influence. Among the variables affecting the knowledge, ability and quality, the experiment design still has the greatest influence, followed by the experiment organization and management, and the laboratory environment has the least influence. Among the variables affecting the

**Table 3.** Model path coefficient and significance test

Path			Regression coefficient	Standard deviation	T-value	P-value
Laboratory environment	→	Attitude and willingness	0.253	0.017	10.084	0.0000
System convenience	→	Attitude and willingness	0.365	0.020	12.076	0.0001
Experiment design	→	Attitude and willingness	0.476	0.019	19.975	0.0002
Experiment organization and management	→	Attitude and willingness	0.128	0.023	3.209	0.0009
Laboratory environment	→	Knowledge, ability, quality	0.079	0.021	1.038	0.0000
System convenience	→	Knowledge, ability, quality	0.138	0.016	3.048	0.0000
Experiment design	→	Knowledge, ability, quality	0.367	0.028	20.487	0.0004
Experiment organization and management	→	Knowledge, ability, quality	0.275	0.023	1.082	0.0000
Attitude and willingness	→	Knowledge, ability, quality	0.204	0.021	3.302	0.0021
Attitude and willingness	→	Teaching effect	0.387	0.020	4.039	0.0000
Knowledge, ability, quality	→	Teaching effect	0.654	0.019	17.873	0.0000

teaching effect, the knowledge, ability and quality have the greatest influence, followed by the attitude evaluation and willingness to use.

The statistical data show that students have a low evaluation of laboratory environment, indicating that laboratory hardware facilities need to be further improved. The students' evaluation on the convenience of software system is also low, which indicates that the current virtual simulation experimental system needs to be optimized or updated. The students' evaluation of the experiment design is not high, indicating that the current experiment design is not reasonable. The students' evaluation of experiment organization and management is medium, indicating that the process of experiment organization and management needs to be standardized. The students' experience of knowledge acquisition, ability cultivation and quality improvement is relatively obvious, which indicates that the virtual simulation experimental teaching of economics has achieved good results.

However, the students' attitude evaluation is not positive, and their willingness to use them is not strong, which indicates that the lag in the hardware and software of the virtual simulation experiments of economics affects the teaching effect to a certain extent.

### **3 Suggestions on the Reform of Virtual Simulation Experimental Teaching of Economics in the Military Academies**

The above empirical analysis results fully reflect that the virtual simulation experimental teaching of economics plays an important role in stimulating students' learning interest, strengthening their understanding of theoretical knowledge, enhancing their practical ability, and improving their economic literacy. At the same time, it also reflects that there are some problems in the virtual simulation experimental teaching of economics in the military academies, such as backward experimental teaching conditions, unreasonable experimental teaching design, non-standard operation and management. Based on this, the virtual simulation experimental teaching of economics in the military academies should be reformed from the following aspects.

#### **3.1 Increase the Investment in the Hardware Facilities of Virtual Simulation Laboratory of Economics**

Most military academies pay much attention to the first investment in the virtual simulation laboratory, but after the completion of the construction, most lack subsequent maintenance, refinement, and improvement. With the integration and development of new generation of information technology such as big data, cloud computing, artificial intelligence, the hardware facilities of laboratory are rapidly aging and inefficient, it is difficult to carry the latest virtual simulation experimental software system of economics. In order to ensure the compatibility of hardware facilities and software systems, military academies should develop a long-term plan for the construction of virtual simulation laboratory of economics, increase the investment in the hardware facilities, and establish a sustainable funding support mechanism. According to the actual needs, funds should be invested annually to upgrade the laboratory hardware to improve operating efficiency [3].

#### **3.2 Cooperate to Develop Virtual Simulation Experimental Software System of Economics with Local Universities and Colleges**

In recent years, most military academies introduced the virtual simulation experimental software system of economics used by local universities and colleges. This approach has low cost and short cycle, but it is difficult to meet the personalized teaching requirements of military academies, for example, it is difficult to integrate military elements into teaching. If military academies entrust software technology companies with independent research and development, which can reflect military characteristics, but the cost is high, the cycle is long, and it is difficult to collect various kinds of economic data in real time because of the closed nature of military organizations. The ideal way is to cooperate to develop virtual simulation experimental software system of economics with local

universities and colleges (such as Chongqing University, etc.). First, it can save cost and improve construction efficiency. Second, on the basis of joint research and development, it can quickly integrate military elements and reflect military characteristics. Third, the open economic data resources of local universities and colleges can be fully utilized to make up for the shortcomings of military academies.

### **3.3 Select Teaching Content of Virtual Simulation Experiments of Economics**

In the vast content system of economics, not all knowledge points are suitable for carrying out virtual simulation experiments. Virtual simulation experiments are more suitable for important concepts of economics, dynamic logical derivation and highly abstract theoretical assumptions. In the case of very limited class hours of economics in the military academies, experimental teaching as an auxiliary means should not occupy too many class hours, otherwise the theoretical teaching cannot be completed on time. However, the experimental teaching should not have too few hours, otherwise it cannot play its important role. Under existing conditions, it is possible to select economics knowledge points that students are interested in and easy to operate for modular experimental teaching design, such as market equilibrium experiment, monopoly market experiment, second-hand car trading experiment, hitchhiking experiment [4]. The modular experimental project belongs to verification experiment, with scattered knowledge points and less class hours, it can be flexibly arranged between theoretical teaching. After the completion of the economics course, a comprehensive virtual simulation experiment of economics can be added to connect various knowledge points and cultivate students' comprehensive analysis ability.

### **3.4 Optimize Virtual Simulation Experiment Design of Economics**

The statistical data show that experiment design is the most important factor affecting students' acquisition of knowledge, cultivation of ability and improvement of quality in the experiments, as well as the main factor affecting students' attitude evaluation and willingness to use experimental teaching system. Optimizing experiment design plays an important role in improving the teaching effect of virtual simulation experiments of economics. First, reasonable experiment rules should be established. The virtual simulation experimental teaching of economics emphasizes "simulation", which means that the experiment rules should reflect the real economic environment as truthfully and objectively as possible, keep consistent with the economic operation rules of the real society, and cannot violate social common principles. Second, the number of experiment samples should be expanded. The practice of virtual simulation experiment of economics shows that when the number of experiment samples is too small, the deviation of any sample will have a great impact on the experiment process, and the expected experiment results may not be obtained in the end. Therefore, expanding the number of experiment samples can reduce the chance of experiment results [5]. Third, the experiment operation process should be standardized. A standardized experiment operation process can guide students to conduct experiments efficiently and help teachers to control the teaching process and effect accurately. Fourth, the data interaction function should be added. By using the database shared with local universities and colleges, the system analysis and screening



of massive economic data were quickly conducted, the corresponding economic analysis model was established, and various economic charts were dynamically generated to help students explore economic laws [6].

### 3.5 Improve Teachers' Teaching Ability of Virtual Simulation Experiments

The statistical data show that teachers' organization and management of experiments is also an important factor affecting students' acquisition of knowledge, cultivation of ability and improvement of quality. Improving teachers' digital teaching ability is an important way to improve the teaching effect of virtual simulation experiments of economics. First, we can encourage members of economics teaching team to participate in virtual simulation experimental teaching training and academic conferences around the country. They can learn virtual simulation experimental teaching methods and skills in this way, and improve information technology literacy. Second, we can invite experts in virtual simulation experimental teaching of economics from local universities and colleges to impart the latest theoretical and practical experience, which guides the members of economics teaching team to improve the teaching method. Third, we can join with the economics teaching teams of local universities and colleges to apply for high-level virtual simulation experimental teaching reform research projects, which combines virtual simulation experimental teaching practice and research closely, and promotes the improvement of teachers' digital teaching ability.

## 4 Conclusion

We make an empirical analysis of the teaching effect of virtual simulation experiments of economics in a military academy. It is found that the virtual simulation experiments of economics do have good teaching effect, but the factors such as laboratory environment, system convenience, experiment design, experiment organization and management affect students' attitude evaluation and willingness to use, which weakens the teaching effect. Based on this, the military academies should increase the investment in the laboratory hardware facilities, cooperate with local universities and colleges to develop experimental teaching software system, choose experimental teaching content rationally, optimize experiment design continuously, and improve teachers' experimental teaching ability greatly.

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