On the Application of Flipped Classroom in Virtual Simulation Experiments Teaching

Yi LIU¹,a, Kan ZHANG²,*

¹Educational Informatization Research Center of Hubei, Central China Normal University, Wuhan, Hubei, China
²School of Finance, Zhongnan University of Economics and Law, Wuhan, Hubei, China

a liuyi136@126.com, * wuhancd360@126.com

Keywords: Flipped classroom; Virtual simulation experiments; Teaching.

Abstract. In order to optimize the virtual simulation experiments teaching mode, perfect the virtual simulation experiments teaching platform, improve the effectiveness of virtual simulation experiments teaching, and meet the needs of financial market development and talents training, this paper introduces the advantages of flipped classroom and analyzes the typical problems of virtual simulation experiments teaching in tradition such as low information content, lack of self-learning and loose teaching organization. And the suggestions on the application of flipped classroom in virtual simulation experiments teaching are proposed in this paper from the aspects of the design of the process of flipped classroom and the design of teaching modules of flipped classroom.

Introduction

Flipped Classroom refers that students use digital materials provided by teachers to study independently before class and then participate in the interactive activities and complete exercises in class.

Flipped Classroom has the following advantages:

(1) Flipped Classroom breaks through the limitations of virtual simulation experiments teaching in tradition. Flipped classroom uses modern information technology to expand the boundaries of teaching and enable students to use the digital materials (audio & video, electronic textbooks, etc.) distributed by the teachers to independently study courses before class, and participate in the interactive activities of classmates and teachers in class to solve the problems and complete the internalization of knowledge.

(2) Flipped Classroom restructures the teaching structure of the virtual simulation experiments. The flipped classroom shifts from "teaching before learning" to "learning first and then teaching," from "focusing on learning results" to "focusing on the learning process".

(3) Flipped classroom updates the teaching idea of virtual simulation experiments. Flipped classroom implements multi-level teaching by the control of teaching video before class and targeted guidance in class to meet the needs of the students' personalized experiments. On the other hand, interactions of flipped classroom before class include interactions between teachers and students, and interactions between students and videos. Interactions of flipped classroom in class include interactions between teachers and students, student-student interactions, which can significantly improve the frequency and quality of classroom interactions.

Literature Review

In recent years, domestic scholars have begun to study flipped classroom. Zhu et. al. (2013) studied the implementation strategy of flipped classroom; Ding et. al. (2013) proposed the teaching design ideas for flipped classroom; Zhang et. al. (2013) studied the online teaching system that supports flipped classroom; Song et. al. (2014) studied the project-based teaching mode of flipped classroom; Dong et. al. (2014) studied the teaching application model based on flipped classroom.
concepts; Hu (2014) proposed a college English flipped classroom mode based on MOOC; Lu (2015) proposed a flipped classroom teaching mode based on the learning ability of students; Jian (2016) analyzed the misunderstandings of the flipped classroom teaching mode and put forward relevant countermeasures and suggestions; Zhang (2016) studied the flipped classroom teaching mode based on deep learning; Zhang et. al. (2017) proposed the concept, evolution, and validity of flipped classroom; Peng (2017) proposed a flipped classroom teaching mode with creative orientation. However, how to apply flipped classrooms in virtual simulation experiments hasn’t been studied by now.

Problems Existed in Virtual Simulation Experiments Teaching

(1) The content of traditional virtual simulation experiments teaching is low. In virtual simulation experiments in tradition, students spend more time preparing experiments in the classroom and have not enough time to operate and discuss experimental results.

(2) Self-study in traditional virtual simulation experiments teaching is inadequate. In virtual simulation experiments in tradition, students mainly conducted experiments under the guidance of teachers. They lacked opportunities and motivation of pre-experimental learning to find problems, operations in experiments to solve problems, and exercises after experiments, which have negative effect on experiments teaching.

(3) The teaching organization in virtual simulation experiments teaching is loose. In virtual simulation experiments in tradition, students’ independent learning, teacher's instruction, students' mutual discussion, and interaction between students and teachers are relatively isolated and difficult to be combined with each other organically.

The Challenges of Flipped Classroom to Virtual Simulation Experiment Teaching

Updating Teaching Concept

In flipped classroom teaching mode, students use the digital materials distributed by teachers to independently study curriculum knowledge before class, and participate in the interactive activities of classmates and teachers in class to solve the problems and complete the internalization of knowledge. The flipped classroom fully embodies the idea of modern teaching. In flipped classroom, how to make teaching videos, how to guide students to learn, how to support students’ learning, and how to evaluate students' learning are all new issues faced by teachers. Therefore, teachers should pay more attention to the new characteristics in the course of flipped classroom.

Using Modern Information Technology

In traditional classroom, many teachers use the traditional teaching tools (books, chalk, and blackboard) to impart knowledge. The application of modern information technology often stays on the PPT courseware. In flipped classroom, audio&video editing and modern information technologies such as network communications are essential. In order to implement flipped classroom and achieve satisfactory effect by organizing students to learn micro-courses through the network, in addition to the traditional teaching capabilities, teachers must also possess modern information technologies and have the ability to produce teaching audio&video and the ability to use the web platform for visual teaching.

Reform of Teaching Methods

In traditional classroom teaching, teachers usually ignore difference in individual ability, and can’t take into account the students’ personality. In flipped classroom, students have more autonomy and can choose the right time for learning according to their preferences. The content and progress of the learning are also completely controlled by the students themselves. In addition, each student has different understanding of the content of learning, and the questions raised are also different. They can record the difficult problems encountered in the learning process, communicate with teachers and other learners in the classroom. Student's personalized learning becomes possible in
flipped classroom. The change in learning methods enables teachers to conduct teaching activities with new ways of thinking and new teaching methods under the guidance of new ideas.

**Adjusting the Teaching Structure**

The student's learning process generally consists of two phases: "knowledge transfer" and "knowledge internalization." In the traditional classroom, “knowledge transfer” is achieved through the interaction between teachers and students, students and students. But "knowledge internalization" is mainly done by students themselves after class. Due to lack of teachers’ support and classmates’ help, "knowledge internalization" often frustrates students. The flipped classroom can restructure the teaching structure. "Knowledge transfer" is conducted before class. Teachers not only provide micro-courses based on video, but also provide online counseling. "knowledge internalization" is done in the classroom through interaction, and teachers can understand students' learning difficulties in advance and offer effective counseling in class. Furthermore, mutual communication between classmates is more conducive to the internalization of students’ knowledge.

**Design of Flipped Classroom in Virtual Simulation Experiments Teaching**

**The Design of the Process of Flipped Classroom in Virtual Simulation Experiments Teaching**

The first step of design is the "knowledge acquisition" process. Teachers make experimental teaching videos based on the teaching objectives and the overall learning situation of the students. Each video addresses one or two specific questions for students to watch before class. Students select the focus, frequency, and speed of watching videos according to their own characteristics to complete the active processing of information. When they have incomprehensible knowledge points, they can watch the video repeatedly at any time or use the various educational resources on the Internet to expand their thinking, and they can communicate with teachers and classmates on the network platform. After completing “knowledge acquisition”, students can do exercises before class on the online platform supported by information technology to check their mastery of knowledge and consolidate their learning content. At the same time, the results of the exercises will also be submitted to teachers so that teachers can know the “blind spot” of each student before class to determine what kind of problem situations should be created in class to help students understand knowledge thoroughly and use them flexibly.

The second step is the process of "knowledge internalization" in class. In the classroom, students can consult teachers about the doubts generated during pre-class knowledge building and get teachers’ inspiration and personalized guidance. Because students have a strong purpose in asking questions, the communication between teachers and students is highly efficient. Based on the content of the lesson and the students’ suspicions in watching videos and completing the exercises, teachers can sum up some exploring issues for students to choose. In the process of exploring, students can develop their ability of self-learning by independent exploration and expand understanding of knowledge in the process of mutual learning and increase their awareness and ability of collaborative learning by group collaboration.

**The Design of Teaching Modules of Flipped Classroom in Virtual Simulation Experiments Teaching**

Resource releasing and sharing function module. Teachers are the direct administrators of teaching resources and are responsible for publishing pre-recorded teaching videos and excellent open resources related to learning content that students can download and learn in the resource releasing and sharing function module. Teachers organically combine relevant knowledge points of each topic through internal correlation to draw a knowledge map and form a structured knowledge network to help students master the relationship of knowledge points as a whole and facilitate the search of knowledge points. If students find more useful information resource during the learning process, they can upload it to the platform and share with other classmates after the teacher's review.
Interactive function module. This module supports online posting, real-time voice and video calling. When students are confused about certain knowledge point in the process of self-learning after class, they can communicate with teachers and classmates and master knowledge efficiently by interactive function module.

Learning detection and tracking function module. This module enables teachers to obtain the information of students’ learning progress and degree of knowledge mastery at any time in order to arrange the experimental exploring activities in class according to the students’ knowledge acquisition situation and help students complete the internalization and application of knowledge.

Resource recommendation function module. The function of this module is to analyze the difficulties of learning and recommend personalized learning resources to promote students' in-depth understanding of knowledge based on the students' in-depth knowledge test results and exposed problems in the experiments.

Conclusions
The Application of flipped classroom in virtual simulation experiments teaching can update the idea of virtual simulation experiments teaching, optimize the virtual simulation experiments teaching methods, perfect the platform of virtual simulation experiments teaching, improve the virtual simulation experiments teaching performance, form a new mode of virtual simulation experiments teaching and achieve the goals of effectively improving the quality of virtual simulation experiments teaching and meeting the needs of finance market development.

Acknowledgements
Teaching Research Project of ZUEL (SY201533). Staff Project of Graduate Education Innovation Plan of ZUEL (2018). Project of “The Analysis of Securities Investment (Experiment)” Course Teaching Reform of School of Finance, ZUEL. Open Project of Educational Informatization Research Center of Hubei (EIRC2018003).

References
[1] H.J. Zhu and Y. Zhu, On the flipped Classroom and Its Effective Implementation Strategy, e-Education Research, 2013, (8), pp. 79-83.
[2] J.Y. Ding, Flipped Classroom Research and Instruction Design, Huang Yanbo, China Educational Technology & Equipment, 2013, (21), pp. 88-91.
[3] X.M. Zhang, W.T. He, Research on Network Teaching System Model Supporting Flipped Classroom, Modern Educational Technology, 2013, 23 (8), pp. 21-25.
[4] Z.X. Song, Q.D. Yu, Research on Project-based Teaching Mode Based on Flipped Classroom, Journal of Distance Education, 2014, (1), pp. 96-104.
[5] L.M. Dong and B.C. Jiao, Research on Teaching Application Model Based on Flipped Classroom Idea, e-Education Research 2014, (7), pp. 108-113.
[6] J.H. Hu, Research on Teaching Mode of College English Flipped Classroom Based on MOOC, Technology Enhanced Foreign Language Education, 2014, (6), pp. 40-45.
[7] Lu Xiaojuan, Flipped Classroom Teaching Design Based on Students' Learning Ability, e-Education Research, 2015, (12), pp. 98-102.
[8] B. Jian, Research on Misunderstanding and Countermeasures of Flipped Classroom, Education Exploration, 2016, (2), pp. 134-136.
[9] G.R. Zhang, Practice of Flipped Classroom Teaching Mode Based on Deep Learning, Higher Education Exploration, 2016, (3), pp. 87-92.
[10] P. Zhang, L. Ding, W.S. Zhang, On the Ideas, Evolution and Effectiveness of Flipped Classroom, Journal of Educational Studies, 2017, (2), pp. 46-55.

[11] H.C. Peng, L.L. Chen, H. Pang, Z.T. Zhu, Flipped Classroom Teaching Style Oriented to Creativity: A Bridge Between Theory and Practice, China Educational Technology, 2017, (7), pp. 58-66.