Empirical Research on Mixed Teaching Effect Based on Multipled Linear Regression Analysis in the Informatization Age
Taking "The Application of Excel in Finance" as an Example

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Abstract. With the support of information technology, teaching means and methods are more diverse, and "Online + offline" hybrid courses based on various platforms have also emerged. What is the effect of hybrid teaching? How to make rational use of the platform, create a hybrid teaching design with the deep integration of information technology and teaching, adopt a more efficient way, make better use of students' spare time, mobilize students' learning enthusiasm to participate in "online" and "offline" learning, and achieve the final teaching goal is worth exploring and practicing. This paper uses multiple linear regression analysis model to explore the most important factors affecting the learning effect of Hybrid Teaching Based on superstar platform in the recent four years of "Excel application in finance" course. The results show that online homework completion has the greatest impact, followed by offline assessment and video viewing. Finally, according to the conclusion of the model, improve the design of hybrid teaching mode based on information platform.

Keywords: Information based teaching · multiple linear regression · teaching effect · hybrid design

1 Introduction

1.1 Research Background and Significance

Under the profound influence of informatization, the teaching methods of courses are becoming more and more diverse, among which the emergence of "Online + offline" hybrid courses based on various informatization teaching platforms has changed the traditional single teaching mode of offline classroom for teachers. Flexible classroom design and online classroom use teaching video fragmentation and other means, which not only break the shackles of time and place, make full use of students' scattered time, improve learning participation, but also provide learners with rich and diverse learning resources, making Mixed teaching more vibrant and dynamic [1].

Mixed teaching is used in many kinds of courses in colleges and universities, but how about the effect of mixed teaching? Whether online teaching has reached the expected

goal, what factors affect the teaching effect, and what factors affect the teaching effect most deserve our consideration and analysis.

The course "Application of Excel in finance" of Tianfu College of Southwestern University of Finance and economics has used the online platform for mixed teaching since 2015 and has had 8 years of mixed teaching experience. Therefore, this paper analyzes the effectiveness of mixed teaching for this course, finds out the factors affecting mixed teaching through regression analysis, and finally designs and improves the mixed teaching of this course.

1.2   Research Methods and Innovation

This paper adopts a combination of theoretical analysis and empirical analysis. Based on the superstar platform, aiming at the data of the hybrid teaching of the course in recent four years, this paper constructs a multiple regression analysis model of the teaching effect, and uses SPSS software to solve it, finds out the main factors affecting the hybrid teaching effect of the course, and puts forward targeted suggestions for improving the design of the hybrid teaching mode of the course [4]. The results of regression model calculation have practical significance on how to improve this kind of practical hybrid curriculum, reasonably adjust the influencing factors, and then improve the teaching effect of the curriculum.

1.3   Relevant Theoretical Basis

1.3.1   Multiple Linear Regression Analysis

Regression analysis refers to a statistical analysis method to determine the quantitative relationship between two or more variables. Regression analysis is divided into univariate regression and multivariate regression analysis according to the number of variables involved [2]. Changes in social and economic phenomena are often affected by multiple factors. Therefore, it is generally necessary to conduct multiple regression analysis, and the optimal combination of multiple independent variables together to predict or estimate the dependent variables, which is more realistic than using only one independent variable to predict.

1.3.2   SPSS Software

SPSS (statistical package for the Social Science) - social science statistical software package is one of the world-famous statistical analysis software. The basic functions of SPSS include data management, statistical analysis, chart analysis, output management and so on. SPSS statistical analysis process includes descriptive statistics, mean comparison, general linear model, correlation analysis, regression analysis, log linear model, cluster analysis, data simplification, survival analysis, time series analysis, multiple response and so on. There are several statistical processes in each category, such as linear regression analysis, curve estimation and logistic regression.

This paper mainly uses SPSS software to analyze and discuss the multiple linear regression model.

2   Models and data

2.1   Background of Curriculum Informatization Construction

Since 2015, the course "Excel application in finance" has first conducted Hybrid Teaching Based on SPOC platform, and has successively introduced superstar, Xue xitong and EQ platforms since 2019. The integration of multiple platforms continues to promote the continuous improvement of informatization teaching content and methods.

The development process of informatization of the course is as shown in Table 1.

After 8 years of mixed teaching development, multi-platform support, and the joint efforts of the curriculum construction team, the curriculum informatization construction has become mature, and several curriculum construction achievements have been achieved, as shown in the Table 2.

The course construction has made a series of achievements. After years of construction, what factors affect the effect of the mixed teaching of the course, what are the main influencing factors, and how to improve the mixed teaching design of the course in the subsequent construction. In view of these problems, this paper establishes a model for the effectiveness and influencing factors of Hybrid Teaching and learning of this course to conduct multiple linear regression analysis.

Table 1. Course informatization development process

Time	Platform	Stage	Informatization Construction	Resources
2010		Students' ability		Syllabus, lesson plan, ppt
2015	SPOC	Mixed teaching, "cloud teaching" stage	Introduce SPOC platform and increase online teaching	Online teaching video; practice; discussion cases
2019	Chao Xing, EQ	Mixed teaching quality improvement stage	Build an intelligent teaching environment of "online platform learning + offline physical classroom + process supervision"	sign in, answer, questionnaire, selection, voting, scoring, grouping tasks

Table 2. Course construction achievements

	Time (Year)	Achievement category	Level
1	2019	Applied demonstration course	Provincial level
2	2020	"First class" (Mixed/Hybrid) courses	Provincial level
3	2021	"Curriculum ideological and political" demonstration course	Provincial level

2.2 Model Establishment

The analysis of this paper mainly adopts the multiple linear regression model using SPSS software. For the "Application of Excel in finance" course, it uses the mixed teaching data for four years from 2019 to 2022 and uses the multiple linear regression model for analysis.

In the Mixed teaching of operation courses, there are many factors that affect the teaching effect. Through the statistical data of the superstar platform of this course and the sorting of various teaching methods of the course, the factors that affect the teaching effect of the course mainly include operation teaching video, online homework, offline classroom, offline assessment, offline discussion, etc., which will have an impact on the teaching effect, Can be used as independent variables for multiple regression analysis of learning effect [3].

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \tag{1}$$

X_i ($i = 1, 2$) is the selected course index that affects the teaching effect, β_I ($i = 1, 2$) is the corresponding coefficient, $\varepsilon N (0, \sigma 2)$, indicating random error.

2.3 Indicator Selection

In the above model, dependent variable y: teaching effect, independent variable X_1: Students' online video viewing; X_2 Online homework scores; X_3 offline assessment scores; X_4 Offline classroom participation; X_5 offline discussion, multiple linear regression analysis. X_5 offline discussion is cancelled when establishing the model because not every class will start, and the number of times is small.

2.4 Data Sources

We use the four-year data of Mixed teaching from 2019 to 2022. Each item is calculated according to the total score of 100 points. This statistical data comes from the teaching data statistics of superstar platform. It is conducted for the students of the courses taught in the past four years, a total of 8 classes, and the students in each class are calculated according to the average score.

Among them, video viewing is scored according to the proportion of viewing completion, 100 points for all viewing completion, and 50 points for 50% viewing. Online homework and assessment scores are calculated according to the original 100 points (Zu, 2022). The participation of online discussion area is scored according to the statistics of superstar discussion area. Offline classroom participation is calculated in proportion to the sub item scores in the transcript (the total score of participation in the transcript is 20 points, multiplied by 5 to calculate the score). The total evaluation result is the student's final course evaluation result of the semester.

2.5 Multiple Linear Regression Analysis Results

According to the model score results, the composite relationship number of the model is 0.984, and the correlation coefficient is 0.968, indicating that the fitting degree of the equation is significant. See Table 2 for details.

Table 3. Model data sources

Time	Class	Total mark	Video viewing	Online excises	Offline test	Offline class
		Y	X_1	X_2	X_3	X_4
2019	A	87.5	95	81	81.3	91
2020	B	88.3	90	80.7	86.7	90
2020	C	90.1	92	84	83.6	92
2021	D	87.73	90.75	81.22	78.67	97
2021	E	88.7	82.4	83.9	85.2	95
2021	F	91.1	94	85.5	83.8	97
2022	G	86.79	94	78	80.64	98
2022	H	86.3	95	77.7	78.8	94

(Data source: according to the statistics of the course superstar platform)

Table 4. ANOVA table

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.984a	0.968	0.927	0.43958

Table 5. Variance analysis

	df	SS	MS	F	Significance F
Regression	4	17.90350266	4.47587566	23.1631681	0.013624663
Residual	3	0.579697343	0.19323245		
Total	7	18.4832			

ANOVA Table 4, f $= 23.163$, sig $= 0.0136 < 0.05$, indicating that the linear regression equation is highly significant. See Table 3 for details (Table 5).

Analyze correlation (Table 6).

Goodness of fit: from the table R Square $= 0.9686$, the degree of linear fitting is high.

F test: when the degree of freedom k $= 4$, n-k-1 $= 3$, table f $= 23.163$, so the fitting of variables has a certain impact on the model. Finally, the following multiple regression equations of the teaching effect of this course are obtained for this model:

$$Y = 10.68 + 0.1353X_1 + 0.50X_2 + 0.19X_3 + 0.085X_4 \tag{2}$$

Table 6. Statistical tests

	Coefficients	Standardized Coefficients	t Stat
Intercept	10.68401	13.73691652	0.77775898
X Variable 1	0.1353364	0.049129543	2.75468396
X Variable 2	0.5068007	0.076059493	6.66321491
X Variable 3	0.1926729	0.091886542	2.09685645
X Variable 4	0.085499	0.06758969	1.26497169

2.6 Model Analysis Conclusion

From the results of the model analysis, it can be seen that the four factors (independent variables) that affect the mixed teaching effect of this course have a high correlation with the dependent variables (learning effect), which will have a significant impact on it. Among them, online homework participation and completion have the greatest impact, followed by offline assessment participation and video viewing completion. It can be seen that in hybrid teaching, offline participation and online participation are indispensable. Online video viewing is the most important means and method of online teaching. Students will basically watch videos as required by teachers in the blended learning of the course, but the seriousness of homework completion. According to these conclusions, we will improve the hybrid classroom design of the course "Application of Excel in finance".

3   Deep Integration of Information Technology and Teaching to Improve Mixed Teaching Design

Based on the superstar platform, create a "three-dimensional integration" (online platform learning + offline physical classroom + process supervision) intelligent teaching environment for the course "excel in finance", adopt the "online" + "offline" teaching mode, improve the construction of online teaching resources, and make full use of information technology to create a high-level hybrid curriculum system.

3.1 Create a "Student-Centered" Intelligent Teaching Environment Based on Superstar Technology

This course is based on superstar technology platform and learning link, with "students as the main body and teachers as the leader" and constructs a three-dimensional intelligent teaching environment of "online platform learning + offline physical classroom + process supervision". The use of information technology runs through the whole teaching practice process.

First, students learn the fragmented video of each module on the superstar platform, complete the video synchronization exercise, master the fragmented knowledge points,

Table 7. Teaching Resources

Category	Name
Basic teaching resources	textbook, syllabus, lesson plan, ppt
Video	Synchronous operation video
	Tutorial video
Case	Synchronization case
	Guide case
Project	Sub module project
	Group integrated project
Discussion	Online symposium discussion
	Current affairs topics
	Class discussion
	Debate theme

and discuss and solve the problems existing in self-study on the platform; Offline physical classes through teachers to explain, guide students to discuss and complete online problems, and set up guided cases and group fragmentation projects to implement the cultivation of students' knowledge, ability, and literacy.

3.2 Informatization Teaching Resource Construction

From the above model conclusion, online video viewing, online homework and offline assessment have a great impact on grades. Therefore, for the development of hybrid teaching, these teaching methods must be based on the enrichment and improvement of various teaching resources. The improvement of teaching resources is very important. The following is the design and improvement of various teaching resources according to the mixed construction of courses, as shown in Table 7.

3.3 Innovating Diversified Teaching Mode

Use various information-based means of the platform, such as sign in, answer, questionnaire, selection, voting, scoring, grouping tasks, etc., so that the entity classroom can fully integrate information-based means, and based on this, innovate the classroom teaching organization mode, and achieve the curriculum objectives more efficiently. Organize the teaching evaluation team to conduct multi-dimensional and comprehensive supervision of the whole teaching process according to the feedback of online statistical data of the platform, and finally establish a multi-dimensional evaluation mode to evaluate the achievement of teaching objectives on the completion of the course, and finally carry out teaching improvement. This teaching environment has laid a solid foundation for the realization of the objectives of the course [5] (Table 8).

Table 8. Teaching Arrangement

	Contents		Platform
Before class	Design integrated project Teaching video viewing		Chao Xing, EQ
Class time	Video matching exercise	Online	
	platform current affairs post discussion Platform process teaching supervision		
	Sign in, answer, questionnaire, selection, voting, scoring, grouping tasks	Offline	
After class	Teaching evaluation + questionnaire survey + Teaching Improvement	Online	

3.4 Design "Incremental" Evaluation Points and Build a Multidimensional Evaluation Model

The team curriculum effectively supervises the teaching process, evaluates the achievement of teaching objectives, and improves them. For the whole learning process, through "qualitative + quantitative" evaluation and "process + result" evaluation, the industry certificate assessment is introduced, the "incremental" evaluation points are designed, and a multi-dimensional evaluation mode is built.

Adopt "3 + 4" three-dimensional evaluation of the whole process. Three levels ("online" + "offline", "process" + "result", "quantitative" + "qualitative"), four common ("students + teaching management team + teachers + enterprise" four side evaluation), based on the superstar platform, evaluate the whole learning process, check whether the quality training of students is achieved at the same time of the course knowledge and ability assessment, guide the teaching improvement, and form a closed loop of student training of this course.

Based on the different starting points of students' initial learning in each course, "increment" is not only to assess students' final learning results, but also to measure students' learning effect through the incremental changes of students' achievements before and after course learning, and to design targeted "increment" evaluation points for students' learning effect.

Combined with the information background, make reasonable use of superstar and other platforms to create a hybrid teaching design with the deep integration of information technology and teaching, make better use of students' spare time, mobilize students' learning enthusiasm to participate in "online" and "offline" learning, constantly improve and perfect the construction of curriculum informatization, practically implement the hybrid teaching design of curriculum, and achieve the teaching objectives of the curriculum.

3.5 Conclusion

Based on the statistical data of superstar platform and students' offline learning data from 2019 to 2022 of the course "Application of Excel in finance", this paper uses

SPSS software to establish a multiple linear regression analysis model to study the influencing factors of the hybrid learning effect of the course under the background of the profound influence of information technology, and comes to the conclusion that online homework participation and completion have the greatest impact, followed by offline assessment participation and video viewing completion. According to the conclusion of the model analysis, the Mixed teaching design of the course is improved: create a mixed teaching design with the deep integration of information technology and teaching, create a "student-centered" intelligent teaching environment, and innovate multiple teaching modes.

With the high development of information technology of today, the development of information technology and the reform of modern education, a large number of courses in colleges and universities carry out mixed teaching, so it is very important to study the effect of mixed teaching, whether it achieves the expected goal, and what factors affect the teaching effect. The research of this paper aims at the analysis and design of the mixed teaching effect, which provides a good reference for the improvement of the mixed teaching design of similar courses in Colleges and universities and provides a certain support for the deep integration of information technology.

Due to course restrictions, the number of samples is too small. In the future, more data can be taken to improve the model to make the data and conclusions more accurate.

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