Sustainable Learning and the Cultivation of Students' Core Literacy From the Perspective of Comprehensive Learning: The Application of Multimedia in a Flipped Classroom

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Abstract Cultivating students' core literacy is the ultimate goal of education. It is restricted by multiple factors and it is necessary to consider that students at different stages have different physiological and physical characteristics. Studies have a great impact on the teaching process. Therefore, this article analyses the various factors that cultivate students' core literacy in classroom teaching under multiple influencing factors with multimedia at the core. It also tracks and researches the sustainable development of students through a case analysis and the characteristics of relevant survey data, using Stata tools for empirical analysis. Finally, feasible measures are provided for the formation of a flipped classroom teaching that cultivates students' core literacy.

1 Introduction

Learning is a long-term process. Ensuring students' sustainable learning and the cultivation of core literacy is the key to modern teaching and is also the focus of current educational research (Xuedong, 2018).

To date, most of the research into sustainable learning and the cultivation of core literacy has been focused on the definition of related concepts, such as sustainable study and core quality (Zailiang et.al, 2019). In combination with the current education process in China, the cultivation of sustainable learning and core literacy has furthered the conceptual analysis, put forward some theoretical schemes (Yandong, 2021), and/or analysed how to mobilise sustainable learning and cultivate students' core literacy in schools (Ye, 2021). These studies are analysed from the context of theoretical and empirical sustainable learning and the necessity and urgency of the cultivation of core literacy in modern teaching. However, they are not proven by experimental tracking or data on actual teaching experiment reforms. To implement these new concepts and ideas into actual teaching, there is a need to constantly adjust the teaching method to explore a suitable teaching mode. Advanced modern education concepts such as sustainable learning and the cultivation of core literacy can be integrated into teaching to help students better experience classroom teaching and acquire more knowledge.

On the basis of the above background, the authors of this paper carried out empirical research on the actual reform of teaching patterns and the perspective of experimental teaching, as well as the integrated perspective of sustainable learning and the formation of students' core accomplishments. This was done by tracking teaching experiment data, a systematic analysis of the subjective and objective factors of sustainable learning, cultivation of the mechanism of students' literacy and the influence of the core role it provides in offering guidance for further teaching reform.

J. Zhang, J. Zou: Sustainable Learning and the Cultivation of Students' Core Literacy From the Perspective of Comprehensive Learning: The Application of Multimedia in a Flipped Classroom

259

2   Materials and Methods

The authors of this paper carried out experimental tracking research and the evaluation of data on 360 students from six universities in Liaoning Province. Each undergraduate business school randomly selected two ordinary classes with similar student performance (30 students in each class). One of the classes has adopted traditional multimedia teaching methods, while the other uses flipped classroom multimedia teaching methods to conduct tracking of a learning experiment. An evaluation team of 10 people was organised in each business school to conduct a two-year teaching tracking evaluation conducted in accordance with the core literacy development standards. The curriculum-related indicators of students and teachers are evaluated every Friday (refer to Table 1 for evaluation methods), and a total of 70 weeks of evaluation (excluding weeks with less than five learning days) are obtained for the empirical part of this article.

After completion of data collection, a total of 25,200 copies of data were imported into Excel, and the collected data was statistically analysed using Stata software.

3   Results

3.1   Description of variables

Based on the above analysis of the factors affecting sustainable learning and core literacy development of flipped classroom students from subjective and objective perspectives, the following variables were selected for empirical study in this paper in order to conduct an empirical analysis on the relevant factors and mechanisms of the development of core literacy among flipped classroom students.

3.2   Model setting and empirical methods

An explanatory model was constructed to reflect the correlation between sustainable learning and the cultivation of students' core literacy from the perspective of comprehensive learning:

Model 1: $Y1_{CAA} = \alpha_1 X1_{SC} + \alpha_2 X2_{SII} + \alpha_3 X3_{COL} + \alpha_4 X4_{TTS} + \alpha_5 X5_{TCE} + \alpha_6 X6_{TMD} + +\beta_1$

Model 2: $Y2_{CEE} = \alpha_1 X1_{SC} + \alpha_2 X2_{SII} + \alpha_3 X3_{COL} + \alpha_4 X4_{TTS} + \alpha_5 X5_{TCE} + \alpha_6 X6_{TMD} + +\beta_2$

Table 1 (below) sets out the variable definitions shown in the above model, where $\alpha_1 ... \alpha_6$ represents the correlation coefficient between the dependent variable and the independent variable, and β_1 and β_2 represent the adjustment coefficient of the model. Based on the above model, the authors of this article used Stata software to perform a model analysis base on the previous data, as well as a stationarity test, cointegration test and cointegration regression on the data, then carried out regression verification on the error correction model to complete the empirical analysis.

3.3   Empirical Results

3.3.1   Results of the data stationarity test

The results of the data stationarity test carried out in the empirical process are shown in Table 1 below. In terms of the stationarity test, the sample data collected has good characteristics of a stationary time series, therefore the regression analysis method can be used to forecast the analysis. The results show that all variables for Y1 and Y2 have good, stable sequence features.

Table 1: Data Stationarity Test

	（1）	（2）
Variable	Y1_CAA	Y2_CEE
X1_SC	0.2554 * (0.4146)	0.4155 (0.2264)
X2_SII	-0.022* (0.0252)	-0.0212 (0.0424)
X3_COL	0.2316** (0.1116)	0.160** (0.052)
X4_TTS	-2.542* (1.132)	0.61 (1.543)
X5_TCE	0.2106** (0.1104)	0.161** (0.034)
X6_TMD	0.2323** (0.1293)	0.1822** (0.062)
Constant Term	0.2316** (0.1012)	0.151** (0.049)
Annual Fixed Effect	Control	Control
F Statistic	11.25***	31.20***
Sample Size	16	16

3.3.2   Cointegration test results

As can be seen by the variables of the stationarity test, although its sequences show a sequence of stability, the variables are also affected by the unit root, therefore it is difficult to estimate and implement directly, hence an equation is required to estimate the combination and cointegration test together in order to test the equilibrium between the variable correlation. As can be seen from the results, all the variables significantly correlate with Y1 and Y2, especially the two subjective variables – student interest degree score (X2_SII) and student learning continuity score (X3_COL), which cointegrate with the student comprehensive ability score (Y1_CAA) and the student comprehensive experience score (Y2_CEE), thus showing significant correlation.

3.3.3   Granger causality test results

In Table 2 below, the Granger causality detection method has been used to detect the co-integration correlation between variables, and the specific detection description is as follows.

Table 2: Cointegration Test Results

Direction of causality	Lag phase	F statistics	F Statistical critical value (5%)	Direction of causality	Lag phase	F statistics	F Statistical critical value (5%)
X1→Y1	1	4.07885	0.0485	→	4	6.75852	0.0112
X2→Y1	1	7.70482	0.0128	→	4	5.63253	0.0189
X3→Y1	4	4.52554	0.0338	→	5	12.2521	0.0071
X4→Y1	1	7.85256	0.0458	→	5	16.3252	0.0042
X5→Y1	2	5.32145	0.0121	→	5	5.12421	0.0158
X6→Y1	3	4.04487	0.2521	→	5	17.2325	0.0232
X1→Y2	1	5.56325	0.0152	→	5	5.42152	0.0412
X2→Y2	2	6.21521	0.0312	→	5	9.85215	0.0128
X3→Y2	3	4.25325	0.0053	→	5	5.12412	0.0148
X4→Y2	3	4.25625	0.0036	→	1	4.95226	0.0258
X5→Y2	2	4.52575	0.00363	→	3	9.65852	0.0402
X6→Y2	1	5.785322	0.0315	→	1	9.36521	0.0085

As can be seen from Table 2 above, by using the Granger causality test, to a large extent the test data indicates that the comprehensive score of teaching skills (X4_TTS), the comprehensive score of teaching content (X5_TCE), and the comprehensive score of multimedia presentation content skills (X6_TMD) directly affect the students' comprehensive ability score (Y1_CAA) and the students' comprehensive experience score (Y2_CEE). Moreover, the influence of Y2_CEE is more significant.

4   Discussion

1）In terms of students' subjective behaviour, the influence of the comprehensive teaching score Y1_CAA is more significant than that of the objective factors, and the influence of objective factors is mainly reflected in the influence of the students' comprehensive experience score (Y2_CEE);

2）From a subjective point of view of the influence on students' comprehensive ability score (Y1_CAA), the students' comprehensive ability score (Y1_CAA) is more influenced by the students' interest degree score (X2_SII) and students' learning continuity (X3_COL). Compared with the attention duration score (X1_SC), the effect was more significant.

3）Objective factors mainly affect the students' comprehensive experience score (Y2_CEE) and the influence of the teaching content comprehensive score (X5_TCE). In addition, the multimedia presentation content skill score (X6_TMD) is higher than that of the teaching skill comprehensive score (X4_TTS).

Based on the above data analysis combined with the actual situation, the factors that affect the development of students' comprehensive literacy can be analysed from two aspects.

The subjective factors include the following:

1） Sustainability of students' attention

From the perspective of developing students' core literacy and sustainable learning, whether flipped or traditional, both teaching models are human-oriented. Both models emphasise the cultivation of students' autonomous learning ability in the learning process. Therefore, in a flipped classroom, students also need to maintain sustainable concentration during the teaching process. It is supposed that students' inattention reduces the effectiveness of teaching, while in flipped classrooms, video learning comes before class learning and in-class interaction. In such cases, students are required to maintain attention for a long time and must pay continuous attention to the knowledge and problems in the course in order to develop the core literacy of sustainable learning through a flipped classroom. Therefore, in the process of analysis, this paper started from the perspective of the sustainability of students' attention, taking it as a subjective factor, in order to conduct an in-depth discussion and analyse the impact of the sustainability of students' attention on student learning and the cultivation of core literacy in a flipped classroom.

2） Students' interest in learning

Different students have different degrees of interest in different knowledge and courses of study. It can be considered that interest is an important factor for students to learn and accept new knowledge. The same interest affects the development of students' core literacy in flipped classrooms. Students with a strong interest in the teaching mode of flipped classrooms are more likely to focus on the relevant knowledge prior to the class. When students' interest is stimulated, they are more likely to accept relevant knowledge autonomously, learn more and have a better experience. In addition, from the perspective of sustainability, students' interests provide them with an advantage in terms of sustainability. According to the above analysis, this research focuses on and analyses the influence of students' core literacy in a sustainable flipped classroom from the level of students' interest in learning, and uses it as a subjective factor to analyse and explore the level of students' interest in learning – whether in terms of the development of core literacy or the relevance and influence of the mechanism.

3) Student learning continuity

Students' continuous learning behaviour is an important manifestation of their core literacy. This behaviour is not only based on students' interests, but also reflects the comprehensive and continuous performance of students in the learning process. Continuous learning behaviour is the execution process and result of students' autonomous learning, and is also an important manifestation of autonomous learning ability. Students who can actively participate in flipped classroom learning in actual teaching will have more opportunities to learn and maintain higher learning efficiency in the classroom.

Therefore, in this study, it can be considered that the enthusiasm of students' participation in the learning process is a subjective influencing factor. From the perspective of the continuity of the enthusiasm of students' participation in learning, its impact on students' sustainable learning and core literacy development can be analysed and explored. It would be helpful to comprehensively analyse the subjective comprehensive influence of students on their sustainable learning and core literacy development.

The objective factors include the following:

1) Teaching skills of teachers

The introduction of core literacy requires teachers' literacy to keep up with the pace of the educational era, and to be continuously improved, in order to 'escort' the cultivation of students' core literacy. The task of the teacher is to impart knowledge to students and to cultivate in them the necessary skills and qualities. This requires teachers to guide students to gain true knowledge on the premise of completing the improvement of their own core literacy in order that they can help in cultivating students' core literacy. Therefore, under the requirements of sustainable learning and core literacy development, teachers should strengthen their professional literacy and establish correct educational concepts.

This article discusses the influence of teachers' teaching skills on students' sustainable learning and core literacy development, and analyses teachers' teaching skills from this perspective, in order to influence the sustainable learning and core literacy development of students in a flipped classroom.

2) Content setting skills

The course content and teaching content directly affect the appeal of the whole course. It also has an effect on the efficiency of the teaching of the entire course to a certain extent. Therefore, courses that are attractive and have rich content are the key to flipped classroom teaching, as well as the basis for students' continuous learning and the cultivation of core literacy. In this aspect, this paper focuses on how teachers combine the characteristics and composition of a flipped classroom, analyses in detail the setting of the curriculum content by teachers and the combination with the mode and structure of the flipped classroom. In addition, the authors discuss the objective impact of the content of the curriculum on students' sustainable learning and the cultivation of students' core literacy.

Therefore, this paper sets the course content for objectively evaluating sustainable learning for students and core literacy, which form one of the important factors of the influence in the evaluation analysis, and also explores and analyses the contents of the course in terms of sustainable learning and the cultivation of students' core literacy.

3) Multimedia display content skills

From the point of view of teaching activities, multimedia video is used to promote favourable support for autonomous learning among students. From the concept of a small class, the method of making multimedia video is very common, since a survey of students found that more than half of them think more fluently in their own language and the speed at which they do so is appropriate. Therefore, this highlights that multimedia video is easy to understand and operate. There are several dimensions in play: logic, clarity and the level of design of the lectures need to be improved. Logic taught by teachers is related to the student understanding effect. The clarity of the pictures directly affects students' self-learning emotions. The

design of levels provides time for students to think and guides them to generalise and apply knowledge.

Therefore, in the research carried out for this paper, teachers' multimedia presentation skills are taken as a key objective factor that affect students' sustainable learning and the cultivation of core literacy, which is used as an objective factor to discuss and analyse its influence on students' sustainable learning and the cultivation of core literacy, and its mechanism of action is analysed.

5 Conclusions

Based on the previous theoretical and empirical analysis, the results show that the indicators selected subjectively and objectively in this article strongly correlate with students' comprehensive level and experience. Based on the empirical results, the following conclusions and suggestions can be drawn:

Teachers should pay attention to inspire students' ability to learn autonomously, cultivate students' interest in the course during the process of teaching, actively promote students' subjective initiative, make students aware of the course of interest, and, in turn, the key is to let students understand the pleasure of their interest in learning, which can subjectively lead to a deeper understanding of learning. The necessity to develop core literacy should be recognised, and guidance on students' learning behaviours and interests should be strengthened to ensure the sustainability of their learning.

The flipped classroom, to a certain extent, has effectively stimulated students' autonomous learning ability. In a flipped classroom, students experience two aspects, to a large extent influenced by the content of the teaching curriculum and the use of multimedia techniques, which require teachers to reverse the process of classroom teaching. Meanwhile, in combining multimedia teaching, the advantages of multimedia teaching should be taken into account, combined with the flipped classroom, and interest should be integrated into the classroom in order to stimulate students' interest in learning and ultimately improve students' course experience.

In the flipped classroom, teachers should make the most of the advantages of multimedia and strengthen the study of multimedia presentation skills, thus stimulating students' interest in learning. This can be achieved by allowing students to, for example, watch a multimedia video prior to class, which can be beneficial in stimulating students' enthusiasm to learn and their quick grasp of relevant knowledge before class, In addition, students can actively interact and communicate with teachers in class in order to maintain the development of sustainable core literacy.

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