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An Investigation into the Factors Influencing Secondary School Students' Deep Learning of English in a Dual-Line Blended Teaching Model

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Abstract- With the development of information technology, online teaching has gradually developed to the stage of dual-line blended teaching, but the current development level is not yet high, and it is not deeply integrated with subject teaching. This study aims to clarify the factors influencing secondary school students' deep learning of English under the dual-line blended teaching mode. To this end, the article first proposes a hypothesis on the factors influencing secondary school students' deep learning of English in a dual-line blended teaching model. The article then used questionnaires and structural equation modelling to test the hypotheses and validate the model. The results found that: secondary school students' English deep learning level is moderate; deep learning is influenced by student factors, teacher factors, interaction factors and environmental factors. Finally, the article proposes suggestions for improving the four factors: students, teachers, interaction and environment, to promote the development of a t dual-line mixed-integration teaching model, cultivate secondary school students' higher-order thinking skills, develop their English core literacy, and thus achieve meaningful learning.

Keywords: dual-line teaching; dual-line blended teaching; deep learning; influencing factors; secondary school students; english language teaching.

I. Introduction

The blended teaching mode, under the background of "Internet+", has been developing rapidly, and online learning has become a common teaching method worldwide. At present, dual-line teaching has gradually moved towards a trend of normalisation and high-quality development, with more and more secondary school courses adopting a combination of "online" and "offline" teaching modes. In 2014, the Centre for the Development of Basic Education Curriculum and Teaching Materials of the Ministry of Education put forward a unit of teaching to promote the development of students' core literacy, forming the "deep learning" teaching model. The teaching practice model of "deep learning" version 1.0. With the deepening of the reform experiments, version 2.0 of the "deep learning" teaching practice model has gradually taken shape, emphasizing the need to build an open learning environment and to promote the deep integration of teaching and information technology. Based on the triadic interaction theory, this paper aims to answer the following three questions: (1) What factors influence secondary school students' deep learning in English in the dual-line blended teaching model? (2) To what extent do these influencing factors affect secondary school students' deep English learning? (3) How can we optimize secondary students' deep learning in English?

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II. Literature Review

The main characteristics of deep learning are that students understand the general meaning of what they have learnt, critically assimilate what they have learnt and integrate the new knowledge with their prior knowledge and experience, forming a system of knowledge with internal logical relationships through the conscious construction of meaning. Dual-line blended teaching differs from the blended classroom in that it focuses on the deeper blending of teaching time and space, ecological constructs, learning and teaching theories. In essence, dual-line blended teaching is an education and teaching system that is organically integrated online and offline, where teachers and students and information technology and other elements are organically integrated to achieve the most optimal effect of deep learning. In recent years, researchers have explored the influencing factors of deep learning, mainly focusing on model building and teaching strategy exploration. Li Zhihe(2018) concluded through quantitative analysis that the main influencing factors of online learning engagement include learner factors, instructor factors, environmental factors and peer factors; Salmon (2013) constructed a model of deep teaching and learning based on the process perspective of the occurrence of online learning, which includes five aspects: access to the course and motivation, online socialization, information exchange, knowledge construction, reflection and development; Martin (2020) and Davis (2018), on the other hand, found through a systematic review that interaction, discussion, participation, and collaboration are productive online learning strategies. Existing research has mainly focused on deep learning under traditional teaching and learning, with little focus on deep learning under a dual-line hybrid teaching and learning environment, and a lack of deep integration of deep learning with subject teaching and learning.

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III. Factor Sorting and Hypothesis

a) Deep Learning Process and Results

Deep learning not only focuses on learning outcomes but also on learning states and learning processes. According to the Deep Learning Scale for College Students developed by Li Yubin et al, deep learning has four dimensions: deep learning motivation, deep learning input, deep learning strategies and deep learning outcomes. Deep learning motivation is related to students' initiative, conscientiousness and motivation in learning; deep learning input mainly includes behavioural, emotional and cognitive input; deep learning strategies refer to students' reflection, criticism and transfer of new knowledge; deep learning outcomes are expressed in students' mastery of core English content and improvement in critical thinking, problem-solving and cooperative communication skills. The results of deep learning are mainly in terms of students' mastery of core English content and improvement of their critical thinking, problem-solving and collaborative communication skills.

b) Deep Learning Factors

Based on the triadic interaction determinism proposed by Bandura and combined with the teaching ecological features of the dual-line blending teaching model, this study will explore the factors influencing secondary school students' deep learning of English in the two-line blending teaching model in terms of students, teachers, interaction and environment. The student factors are mainly students' metacognitive ability and self-efficacy (Xu, Z.G., 2023). The stronger the metacognitive ability, the stronger the students' self-regulation ability, and the more they can promote the use and improvement of English deep learning strategies; the stronger the self-efficacy, the stronger the students' interest in learning English, and the more they can improve their deep learning engagement. The teacher factor focuses on teachers' competence in information-based teaching (Qiu, 2020), where teachers take advantage of online learning platforms and higher-order activity designs to guide students in mastering digital English learning strategies and promote deeper inquiry, thereby optimizing deeper English learning outcomes. In addition, the Alliance for Excellent Education (USA) shows that teachers effectively deliver deep learning, where teachers teach students rich core knowledge points by using innovative teaching strategies or methods and students put what they have learned about English into practice in their lives. The interaction factor is mainly the multiple, immediate and deep interactions between teachers and students, students and students and human and machine (Li, 2018), where the process of critical questioning, dialectical interpretation and negotiation of opinions helps students to deepen their understanding of English knowledge and facilitate problem-solving, which in turn increases students' deep learning engagement and interest in learning. The environmental factor is the core factor that distinguishes deep learning from other deep learning, mainly the two-line hybrid intelligent learning environment built on "Internet+" education. The personalized English learning resources and learning environment provided by the smart tools can support students' independent and collaborative learning, enhance students' interest and motivation in learning, and thus improve deep learning outcomes. Based on the above research and inferences, this study proposes the following hypotheses:

H1: Student factors had a positive and significant effect on motivation to learn English in depth.

H2: Student factors have a positive and significant effect on deep learning engagement in English.

H3: Student factors have a positive and significant effect on deep learning strategies in English.

H4: Teacher factors have a positive and significant effect on deep learning engagement in English.

The H5 interaction factor had a positive and significant effect on motivation to learn English in depth.

The H6 interaction factor had a positive and significant effect on deep learning engagement in English.

H7: Environmental factors have a positive and significant effect on motivation to learn English in depth.

IV. Research Design

a) Research Tools and Data Processing Methods

The questionnaires covered in this study include "The current situation of deep learning of English in secondary schools in a dual-line blending teaching model" and "Factors influencing deep learning of English in secondary schools in a dual-line blending teaching model". According to the "Depth Learning Scale for College Students" compiled by Li Yubin et al, a questionnaire called "The current situation of deep learning of English in secondary schools in a dual-line blending teaching model" was designed. In total, 20 questions were asked on a five-point Likert scale. In addition, based on Bandura's reciprocal determinism, the questionnaire "Factors influencing deep learning of English in a dual-line blending teaching model" was designed according to the characteristics of the information technology environment of the dual-line blending teaching mode, mainly including student factors (5 questions), teacher factors (5 questions), interaction factors (5 questions) and environmental factors (5 questions). (5 questions), with a total of 20 questions, using the five-point Likert scale as well.

Based on the test results, the Cronbach'sα for each dimension and overall was above 0.8, indicating good reliability of the questionnaire. The KMO test

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coefficient was 0.946 and the significance of the Bartlett's sphericity test was 0.000, indicating suitability for exploratory factor analysis. After rotation of the initial factor loading matrix, the attribution of each question item was as expected, indicating good validity of the questionnaire. Finally, using the Fornell-Larcker criterion to test the discriminant validity of the questionnaire, the standardised correlation coefficient between the two dimensions was found to be less than the square root of the AVE value corresponding to the dimension, thus indicating that the dimensions have good discriminant validity.

b) Data Processing Methods

The empirical analysis of the sample data was carried out with the help of SPSS 28.0 and AMOS 26.0. Firstly, descriptive statistical analysis, correlation analysis and normality testing of the sample data were conducted using SPSS 28.0 to capture the basic characteristics of the variables, correlations and distribution patterns of the sample data. Then, AMOS 26.0 was used to conduct validation and path analysis to investigate the extent to which various influencing factors had an impact on secondary school students' deep learning of English in a dual-line blended teaching model.

V. Research Results and Analysis

a) Descriptive analysis

Using an online platform, the questionnaire data was sourced from a total of over 200 secondary school students from 22 provinces in China, mainly in their second year of high school. The overall ratio of males to females was approximately 1:1, with 79.67% of the participants having experienced a live blended classroom and 31.4% preferring a traditional classroom to a dual blended classroom. The results of the analysis of each variable showed that the mean score M for each variable was between 2 and 3, the scale scoring was 1-5 positive, and the standard deviation SD for each question item and the overall standard deviation SD were less than 1.5, so the cognitive and behavioural levels of the group of participants in this study were at a moderate level in both English deep learning and factors influencing English deep learning. The results of the normality test for each of the measured question items indicated that the absolute values of the skewness and fronting coefficients were less than 1, within the range of criteria proposed by Kline (1998), and the variables tested for this data can be considered to obey a normal distribution.

b) Correlation Analysis

In this analysis the correlations between multiple variables were analyzed exploratively through Pearson correlation analysis. According to the results of the analysis, it can be seen that there are significant correlations between the variables in this analysis, and they are all significant at the 99% level, and according to the results of the correlation coefficients, it can be seen that the correlation coefficients r between the variables are all greater than 0, so it can be shown that the variables All of them are significantly and positively correlated with each other.

Table 1: Results of Pearson Correlation Analysis between Dimensions

Dimensionality	DJ	TR	CL	JG	GR	JS	JH	HJ
DJ	1							
TR	.482**	1						
CL	.512**	.459**	1					
JG	.468**	.414**	.435**	1				
GR	.428**	.339**	.367**	.316**	1			
JS	.452**	.192**	.287**	.324**	.289**	1		
JH	.434**	.310**	.260**	.277**	.261**	.449**	1	
HJ	.437**	.218**	.260**	.375**	.316**	.445**	.234**	1

*** Significant correlation at 0.01 level (two-tailed).*

c) Structural Equation Modelling

i. *SEM Model Fit Test of Secondary School Students' English Deep Learning Influences*

According to the model fit test results in the Table2, CMIN/DF = 1.414, which is in the range of 1-3, and RMSEA = 0.057, which is in the good range of <0.08. In addition, the test results for CFI, IFI and TLI all reached an excellent level of 0.9 or more. Therefore, the combined results of this analysis can indicate that the deep learning SEM model has good fitness.

Table 2: Standardized measurement model fitting results

	x2/df	CFI	IFI	TLI	RMSEA
Threshold values	<3	>0.9	>0.9	>0.9	<0.08
Fitted values	1.58	0.914	0.915	0.907	0.057
Is the standard met	Yes	Yes	Yes	Yes	Yes

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ii. *SEM Model Pathway Relationship of Factors Influencing Secondary School Students' English Deep Learning*

The study used structural equation modelling to test each hypothesis, mainly to explore the extent to which each of the four influencing factors of English deep learning affects each of the four representations of deep learning, and thus to identify the main factors affecting secondary school students' deep learning of English. All hypotheses were tested if the significance p-value was less than 0.05, the critical ratio C.R. value was higher than 1.96, and the standardised path coefficient values were within a reasonable range. In the path hypothesis relationship test for this study, the student factor significantly and positively predicted motivation ($\beta=0.349$, $p<0.001$), engagement in learning ($\beta=0.419$, $p<0.001$) and learning strategies ($\beta=0.509$, $p<0.001$), therefore hypotheses H1, H2 and H3 were valid. Compared to the student factor, while the teacher factor and interaction factor had a smaller impact on deep learning, the standardised path coefficients were all less than or equal to 0.157.

Table 3: Results of the SEM path relationship test for deep learning influences

Path relationships			Estimate	S.E.	C.R.	P
Student Factor	→	Motivation to learn	0.44	0.104	4.922	***
Student Factor	→	Learning input	0.419	0.098	4.813	***
Student Factor	→	Learning Strategies	0.509	0.112	5.603	***
Teacher Factor	→	Learning input	0.157	0.072	2.006	0.045
Interaction factors	→	Motivation for learning	0.13	0.063	1.967	0.046
Interaction factors	→	Learning input	0.124	0.068	1.9742	***
Environmental factors	→	Motivation to learn	0.349	0.092	3.981	***

*Note: *** indicates $p \leq 0.001$.*

VI. Research Findings

a) *The level of in-depth English learning of secondary school students in the dual-line mixed-integration teaching mode still needs to be improved.*

According to the results of the descriptive statistics, secondary school students' cognitive and behavioural levels of both English deep learning and factors influencing English deep learning were at an intermediate level, with senior students outperforming their junior counterparts in English deep learning. The reasons for this are that students in the upper grades were clearer about their English learning goals and the importance of English learning, and their interest and motivation to learn were at their peak in order to improve their English proficiency and understanding of deep English learning. In the individual interviews, some of the younger students indicated that they were not comfortable with the two-line blended teaching model, while the older students had gradually become familiar with the content, format and methods of the two-line blended teaching model in the early stages of their learning, and had developed effective strategies for in-depth English learning, gradually breaking away from the habit of passive receptive learning and beginning to try to complete learning tasks through independent thinking or peer collaboration.

b) *Secondary Students' Deep Learning of English is Mainly Influenced by Student Factors, Interaction Factors and Environmental Factors.*

Motivation to learn English in depth is closely related to student factors, interaction factors and environmental factors, the most significant of which is the student factor. The student factor includes self-efficacy and metacognitive skills. Self-efficacy in the two-line blended teaching model includes general self-efficacy and informational self-efficacy, i.e. students' interest and confidence in learning in different English learning tasks and English situations, and students' confidence in using information software devices and solving IT problems in an informational teaching environment. The more confident students are in learning in different English tasks and contexts in a dual-linked, blended English classroom, the more internal motivation they will have to learn, and thus deeper learning will occur. Students are more motivated to engage in English learning if they believe they can learn something in a dual-line blended teaching model; if they believe they will not gain much, they will avoid or devote less energy to the task. Secondly, IT and the dual-line teaching ecology complement students' deeper learning of English; students rely on IT for resources and help, and the dual-line teaching ecology is optimised based on students' learning outcomes and trial feedback.

Deep learning engagement in English is related to student factors, interaction factors and teacher factors, the most significant of which is the metacognitive skills of the student factors. The stronger the metacognitive ability, the better the secondary students' self-awareness, self-reflection, self-evaluation and self-regulation in English learning activities, and the more likely they are to achieve high levels of behavioural, emotional and cognitive engagement in the two-line blended teaching model. The second factor is the interaction factor and the teacher factor, which includes multiple and timely interactions between

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students, teachers and the human-machine. Teachers are able to effectively use the characteristics of the intelligent environment to select a variety of teaching methods and assessment methods according to the teaching content, thus guiding students to actively engage in collaborative group learning, motivating students to take the initiative to speak up in the learning process of the course, providing more opportunities for students to demonstrate their abilities and providing timely and personalised help and feedback.

Deep learning strategies in English are influenced by student factors. To achieve flexibility in the use of deep learning strategies, it is necessary to consider not only what strategies to use, but also "how to use", "when to use" and "why to use", and this process undoubtedly Metacognitive skills are required. Metacognitive skills facilitate the use of rules, methods, techniques and moderation in problem solving, as well as the development of core academic content, critical thinking, complex problem solving and collaborative communication skills.

VII. Research Recommendations

Based on the findings of the study, it can be seen that the following recommendations are made in relation to the factors influencing learners' deep learning of English at four levels: students, teachers, interaction and environment:

For students, they should develop their deep learning skills in English in different ways by developing their interest or self-efficacy in learning English, as motivation is an important influencing factor in their deep learning. In addition, they need to identify their shortcomings and then work on developing good habits to remedy their deficiencies in English learning, step by step and little by little. For example, they can combine long-term planning with short-term planning and consciously monitor and reflect on their learning process. In short, deeper learning of English is only possible for students if they make their own behavioural or conceptual changes in their English learning. After all, a person's internal factors play a decisive role in his or her learning.

For teachers, it is important to enhance their competence in information technology and to achieve a two-pronged deep integration of teaching philosophy and teaching methods. Firstly, whatever the mode of teaching, it is essentially a way of nurturing people. Teachers need to pay attention to the unique growth needs and life experiences of secondary school students, and build a growth connection between everyday life experiences and English subject knowledge. Secondly, teachers need to be able to fully understand, grasp and implement the different processes and logics of online and offline teaching, mix and blend various teaching methods, design their own teaching programmes, content and processes flexibly, and realise a 'shared' knowledge activity space for teachers and students.

For the interaction factor, it is important to enhance the frequency, quality and depth of interaction as much as possible. Provide students with opportunities to showcase themselves, encourage each student to actively express their attitudes and opinions, achieve sharing and collision of ideas in communication, cultivate students' view of English learning, develop critical thinking and develop a sense of communication and cooperation. At the same time, we improve the way teachers collaborate with smart tools, improve the way interaction is achieved and the evaluation mechanism, accurately measure where each student struggles with English learning, develop personalised learning programmes, dynamically monitor students' learning behaviour and provide emotional support.

For environmental factors, the information technology environment needs to provide students with as much authentic context as possible. Building a multimodal learning resource platform, providing students with immersive learning experiences, switching learning contexts according to learning objectives and needs, guiding students to learn and construct knowledge from multiple perspectives and pathways, and promoting the formation of a lasting internal drive for students to ultimately achieve an overall improvement in knowledge, thinking and ability.

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