Influence of Teacher-Student Interaction on Course Learning Effect in Distance Education

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Abstract—Comprehensive integration of 5G, artificial intelligence and other technologies into education has fully demonstrated openness and flexibility of distance education, which attracts a large number of learners to study. Good teacher-student interaction in distance teaching plays a significant role in improving the quality of course teaching and teachers' career development. Based on the Classroom Assessment Scoring System (CLASS) questionnaire, the influence of emotional support, classroom organization and teaching support of teacher-student interaction on course teaching effect in distance education was analyzed, the difference of learning effect of whether students like distance education were analyzed. Results show that the reliability coefficient of the questionnaire is 0.938, and the KMO value is 0.892. The reliability and validity of the questionnaire are very good. Two aspects of teacher-student interaction (classroom organization and teaching support) can improve the learning effect. Whether samples like distance education have a significant effect on learning effect (p<0.05). The learning effect of learners who like distance education is significantly higher than those who do not. Conclusions have important reference value in clarifying the main types and contents of teacher-student interaction, improving students' subjective feeling ability of curriculum education, promoting learners' active participation in classroom teaching activities, and maintaining smooth interaction with teachers.

Keywords—distance education, teacher-student interaction, course learning effect

1 Introduction

With effective combination of modern educational equipment, a high-speed network and a large number of learning resources, distance teaching has become mainstream way for Chinese learners to receive education and occupies a very important position in China's education market. Especially under the background of gradual improvement of educational information technology, distance education has been enthusiastically pursued by learners because of its more open, flexible and cross-time characteristics. At present, the number of learners, courses and teachers in distance education is increasing rapidly year by year. However, due to the lack of effective

face-to-face emotional interaction between teachers and students in distance education, open and flexible characteristics of distance education also reflect disadvantages of great discount and unclear teaching results. Therefore, distance education is also facing problems of how to ensure curriculum effect. At present, distance education focuses more on teaching of knowledge and does not realize in-depth excavation of teaching system, knowledge system and internal logic of the course.

Therefore, by making full use of characteristics of learners' flexible learning time and flexible learning place in distance education mode, it may adopt fragmented learning methods, fully open curriculum teaching focus in the curriculum, design teaching links, promote distance education learners to realize timely and high-quality curriculum education, and combine curriculum focus with learners' work reality, to get better experience and higher quality learning effect.

The starting point of distance education is to emphasize learner-centered, which does not mean that learners can rely entirely on their efforts. In distance education, teachers play an indispensable role. A large number of studies also show that effective teacher-student interaction in distance education is very important. Therefore, teachers must guide learners with appropriate teaching methods. In teaching interaction, teachers must adopt appropriate teaching forms and scientific teaching methods to promote learners to experience learning happiness, to stimulate learning motivation, master learning skills, and improve learning ability. In fact, it puts forward high requirements for teachers' knowledge, quality and teaching design ability. In particular, the number of centralized face-to-face instruction is limited. Teachers must change their inherent understanding of the lack of learning motivation of distance education learners, and explore influencing factors of effective development of interactive teaching activities from their own and teaching process. Therefore, under the background of distance education, this study uses empirical analysis to explore the impact of teacher-student interaction on learners' curriculum teaching effect. Finally, it puts forward some suggestions to help full-time distance education teachers and learners establish a good interactive relationship, and improve the quality of distance teaching links, to improve the teaching quality of distance education.

2 Theoretical background and research hypothesis

2.1 Theoretical background

Subsequently, a large number of educational researchers introduced symbolic interaction theory into the field of teaching, conducted a large number of researches on the interaction between teachers and students, students and students, and achieved very fruitful research results. Finally, a more systematic teaching interaction theory was formed. At present, most literature believed that teachers and students were two main aspects affecting learning effect and that especially interactive behavior between them in the classroom was an important factor. By adopting teaching behavior, teachers promoted students' understanding of courses. Students produced interactive behavior and gave appropriate responses to teachers, which led to further development

of teachers' teaching behavior. Interaction between teachers and students was a process in which teachers and students influenced and promoted each other to improve teaching quality. At the same time, with the gradual improvement of constructivism and other theories, the theory of teacher-student interaction was also more transferred from classroom teaching to various learning scenarios such as online learning, ubiquitous learning, and fragmented learning.

2.2 Research hypothesis

Teacher-student interaction is an interactive process in which teaching and students interact, communicate and promote each other. Promoting quality of teacher-student interaction and providing the frequency of teacher-student interaction have become core concepts in education and teaching methods of cultivating innovative talents. Due to limitations of teaching environment, teaching time and other factors, the number and quality of teacher-student interaction are limited. Therefore, in distance education, teachers must make full use of the good advantages of distance teaching platforms across time and space to fully carry out interaction on the platform, to comprehensively improve the learning effect. As for the relationship between teacher-student interaction and learner effect, research of Nassaji et al. [1] showed that efficient teacher-student interaction was an inevitable link in teaching. As an unavailable teaching behavior, teacher-student interaction was of great value to the improvement of learner efficiency and learning performance. Leder [2] videotaped the sixth-grade classroom in three different environments: mathematics, language, and science. Research results showed that interaction between teachers and different groups was very consistent, and there were some important differences in quality and quantity between teachers and boys and girls. Research by Pennings et al. [3] showed that in classrooms with preferred teacher-student relationships, teachers' behavior and adaptation to students' behavior were more in line with professional standards than those with poor teacher-student relationships. Lyster [4] studied the role of negotiation in teacher-student interaction, believed that negotiation was of great value to interaction between teachers and students, and thought that more consideration should be given to the use of negotiation teaching method in teacher-student interaction, which could improve learners' learning effect. Research results of Tsang [5] showed that teachers' high-quality teaching feedback was helpful for students to correct appropriate pronunciation errors and to improve their pronunciation level. Cheng et al. [6] explored teacher-student interaction in learning activities. Results showed that students' learning motivation was generally enhanced, and different behavior patterns of teacher-student interaction had obvious differences. Research by Cho et al. [7] showed that there was a positive correlation between teacher-student interaction and educational performance. Learning motivation and teacher-student interaction could explain 59.7% of differences in learners' satisfaction and put forward strategies and preventive measures to promote learners' motivation and teacher-student interaction. Research by Lee [8] showed that good interaction between teachers and students was significantly related to students' behavior and emotional participation, and the relationship between teachers and students was a significant predictor of reading achievement.

Hawkins et al. [9] used hierarchical logistic regression to show that improvement of quality and frequency of teacher-student interaction led to an increase in the possibility of course completion, but it had the least impact on achievement. The empirical results of Fowler et al. [10] showed that externalization and prosocial behavior level of students had a significant impact on the quality of the teacher-student relationship, and that the quality of the teacher-student relationship had a clinically significant impact on academic scores. Pianta [11] found that teacher-student interaction could significantly improve students' learning and development. Asterhan et al. [12] triangulated teacher survey data through deep teacher interviews. Research results showed that forms of interaction between teachers and students are different and that different forms of interaction had different effects. Harper et al. [13] believed that in learning activities, technology promoted cooperation between teachers and students. Teachers who used technology made maximum use of technology, which aimed at promoting students to explore content. From existing research literature, it can be seen that teacher-student interaction includes knowledge transfer, skill training and teaching management. Effective implementation of efficient teacher-student interaction must require joint efforts of teachers and learners. Teacher-student interaction plays an obvious role in promoting the achievement of educational objectives, learners' acquisition of practice, increase of emotional investment and improvement of learning ability. However, due to differences of cultures, there are some different conclusions in the empirical study of types and performance of teacher-student interaction on learners' performance. Therefore, this study considers using CLASS questionnaire system for empirical research, to evaluate learning effect of learners, to reflect process and effect of teacher-student interaction, to measure impact of three specific aspects of teacher-student interaction on learners' learning effect in distance education, and to put forward effective teaching strategies for strengthening teachers' teaching reflection. It may improve their teaching ability, purposefully improving the quality of teacher-student interaction in the teaching process, and create a more suitable distance teaching environment for learners' learning cognition, emotional communication and ability improvement. Therefore, this study puts forward the following three hypotheses.

- H1: In distance teaching, emotional support can significantly and positively improve learning effect of the course.
- H2: In distance teaching, class management can significantly and positively improve learning effect of the course.
- H3: In distance teaching, teaching support can significantly and positively improve learning effect of the course.

3 Research design

3.1 Questionnaire design

This study designs the questionnaire on the impact of teacher-student interaction on curriculum learning effect in distance education. In terms of teacher-student inter-

action, research on classroom teacher-student interaction has achieved relatively perfect results. At present, the most recognized and widely used research tool is the CLASS. Evaluation criteria of class include three primary indicators, corresponding to 4, 3 and 3 questions respectively. Therefore, this study uses 10 questions to measure three aspects of teacher-student interaction (emotional support, class management and teaching support). In addition, this study investigates The Outline of Modern Chinese History of a school of Marxism in Zhejiang Province. Learning effect is measured by ratio of final grade / mid-term grade, and the ratio is converted to a range of 7-1. At the same time, four questions are set to represent the basic information of learners.

3.2 Research objects

As The Outline of Modern Chinese History is a basic compulsory course for freshmen in the university, the survey object of this study is freshmen of a certain undergraduate university in Zhejiang Province. 234 paper questionnaires are distributed. 219 are recovered, and 189 valid questionnaires are obtained after excluding invalid questionnaires, with an effective recovery rate of 80.77%. Basic information of students is shown in Table 1.

Table 1. Descriptive statistical results of questionnaire objects

Name	Question options	Coded value	Frequency	Percentage (%)	Cumulative percentage (%)
Gender	Male	1	114	60.32	60.32
	Female	2	75	39.68	100
Like/Dislike distance learning	Like	1	92	48.68	48.68
	Dislike	2	97	51.32	100
Age	Less than 18	1	23	12.17	12.17
	18-25	2	39	20.63	32.8
	26-35	3	68	35.98	68.78
	36-45	4	34	17.99	86.77
	45-60	5	18	9.52	96.3
	Above 60	6	7	3.7	100
Distance learning time	Less than three months	1	26	13.76	13.76
	Three months to six months	2	43	22.75	36.51
	Half a year to one year	3	14	7.41	43.92
	One to two years	4	24	12.7	56.61
	Two to three years	5	4	2.12	58.73
	Three to five years	6	54	28.57	87.3
	Five to ten years	7	20	10.58	97.88
	More than ten years	8	4	2.12	100
Total			189	100	100

4 Results

4.1 Reliability and validity test

There are many methods of reliability analysis. At present, the most commonly used is the reliability coefficient, namely Cronbach's α. Generally, if Cronbach's α is above 0.8, the reliability of the questionnaire is acceptable and it has a use-value.

As it can be seen from Table 2, the value of reliability coefficient is 0.938, which is greater than 0.9. It indicates that the reliability quality of research data is very high and it is suitable for further analysis.

Table 2. Reliability test results

Variable name	Question number	Total correlation of correction items (CITC)	Item deleted α coefficient	Cronbach's α	Cronbach's α
Emotional support	A1	0.825	0.905	0.926	0.938
	A2	0.875	0.888		
	A3	0.885	0.884		
	A4	0.732	0.934		
Classroom management	B1	0.907	0.942	0.958	
	B2	0.923	0.930		
	B3	0.904	0.944		
Teaching support	C1	0.911	0.916	0.951	
	C2	0.901	0.924		
	C3	0.877	0.942		

It can be seen from Table 3 that corresponding commonality values of all research items are higher than 0.4, indicating that research item information can be effectively extracted. In addition, the KMO value is 0.892, which is greater than 0.6, and data can be effectively extracted. In addition, variance interpretation rates of the three factors are 32.094%, 28.623% and 28.415% respectively. Cumulative variance interpretation rate after rotation is 89.131%, which is larger than 50%. It means that amount of information on the research item can be extracted effectively. KMO value is 0.892, and it's greater than 0.8. Research data is very suitable for extracting information.

Table 3. Validity results

Name	Factor load factor			Common degree (common factor variance)
	factor 1	factor 2	factor 3	
A1	0.278	0.379	0.787	0.841
A2	0.282	0.327	0.841	0.893
A3	0.298	0.23	0.873	0.904
A4	0.648	0.176	0.587	0.795
B1	0.916	0.164	0.25	0.928
B2	0.897	0.236	0.243	0.92
B3	0.88	0.234	0.269	0.901
C1	0.206	0.902	0.254	0.921
C2	0.224	0.875	0.305	0.909
C3	0.181	0.9	0.236	0.9
Eigen value (before rotation)	6.439	1.533	0.941	-
Variance interpretation rate% (before rotation)	64.395%	15.325%	9.411%	-
Cumulative variance interpretation rate% (before rotation)	64.395%	79.720%	89.131%	-
Eigen value (after rotation)	3.209	2.862	2.841	-
Variance interpretation rate% (after rotation)	32.094%	28.623%	28.415%	-
Cumulative variance interpretation rate% (after rotation)	32.094%	60.716%	89.131%	-
KMO	0.892			-
Bart spherical value	2097.397			-
Df	45			-

4.2 Correlation analysis

It can be seen from Table 4 that there is a significant correlation between teaching effect and three aspects of teacher-student interaction (emotional support, class management and teaching support), and correlation coefficients are 0.446, 0.428 and 0.521 respectively, which are significant at the significance level of 1%. It shows that the teaching effect is closely related to three aspects of teacher-student interaction.

Table 4. Correlation analysis

	Emotional Support	Classroom management	Teaching support	Teaching effect
Emotional support	1			
Classroom management	0.673**	1		
Teaching support	0.616**	0.476**	1	
Teaching effect	0.446**	0.428**	0.521**	1

* $p<0.05$ ** $p<0.01$

4.3 Regression results

As can be seen from Table 5, it is found that the model passes F test (F= 28.513, p<0.05), which means that model construction is meaningful. It is found that all VIF values in model are less than 5, which means that there is no co linearity problem. D-W value is near number 2, which shows that the model has no auto-correlation. There is no correlation between sample data, and the model is good.

Table 5. Linear regression results

	Standardization coefficient	**T**	***P***	**VIF**	**R^2**	**Adjust R^2**	**F**
Constant	-	3.584	0.000**	-	0.316	0.305	F(3,185)=28.513, *P*=0.000
Emotional support	0.084	0.905	0.367	2.306			
Class management	0.192	2.317	0.022*	1.85			
Teaching support	0.378	4.872	0.000**	1.63			
D-W value: 1.871							

* p<0.05 ** p<0.01

Hypothesis 1 is not true. Emotional support does not significantly improve the learning effect of the course. Main reason lies in the video playing mode adopted in distance education. In real teaching, distance education focuses more on knowledge teaching, and takes learners' memory of knowledge and examination as the starting point. However, the essence of distance education is to fully realize teaching through distance teaching platform, to create a good online emotional interaction atmosphere between teachers and students. It may establish a harmonious teaching relationship between teachers and students, give learners a high degree of learning autonomy, obtain a sense of learning efficacy and high-quality learning experience, and establish a sufficient psychological preparation state, to improve learning effect. However, at present, quality of most distance education in China is not high, and simple and single ways such as playing videos and learners browsing PowerPoint are used for classes. In distance teaching, teachers don't interact with students in time during teaching, and don't give learners enough language incentives, facial smiles, physical communication and other behaviors. They could not make learners feel emotional support from teachers in real-time, don't fully realize that distance teaching platform is the main position of teacher-student interaction, and finally don't let learners have a sense of identity with teachers, students and learning activities. Long-term lack of emotional support from teachers and students leads to adult learners' learning burnout, which is in a negative state of learning frustration. A long period of negative learning will reduce learners' learning confidence and enthusiasm. Distance education uses more learners' messages in bulletin board system forum, and teachers don't reply in time, resulting in learners' lack of efficient real-time interaction. At the same time, teachers cannot stay on computer in real-time to reply to distance learners one by one, and reasonable opinions of learners cannot be adopted in time one by one, resulting in the loss of learners' right to speak in class. Learners' good classroom display space is comprehensively limited and their learning ability is not fully displayed. For a long time, learning state of low efficiency will make learners unable to give full play to the

master's learning consciousness. It will not produce more endogenous motivation to actively invest in classroom learning, and will comprehensively reduce learners' curriculum learning effect. This conclusion is consistent with conclusions of most research literature, and also focuses on enlightening distance teaching managers to pay attention to emotional interaction between teachers and students, students and students in distance teaching, and to give up the simple way of playing video and innovate teaching methods, to make the emotional interaction more complete.

Hypothesis 2 is true. Class management can significantly and positively improve the learning effect of the course. In distance teaching, teachers can use high-quality distance teaching platforms and adopt more diverse, orderly and efficient class management to promote adult learners to make full and efficient use of learning time, and they can create a good atmosphere for teacher-student interaction. In distance teaching, teachers convey teaching objectives, learning behavior standards and other requirements to students through distance teaching platform, so that students can be in the state of organized learning activities. Through the real-time performance monitoring and analysis platform of distance education platform, teachers find advanced individuals on learning platforms, establish learning models, enable excellent learners to share their learning experience and methods in time, and promote other learners to integrate into the teaching system faster. Teachers use group discussion, group cooperation and random questions in teaching class to promote learners to complete various teaching activities with high quality. By using sea volume teaching materials in distance teaching platform, teachers make learners' learning interest at a high level, making learners more active and spending enough time to complete distance learning tasks. At the same time, the classroom teaching language of distance teaching teachers should be more vivid, and easy to understand, which improves the learning results of learners.

Hypothesis 3 is true. Teaching support can significantly and positively improve learning effect of the course. Main reason is that essence of teacher-student interaction in distance education is the communication behavior between teachers and students to achieve the purpose of education. Teacher-student interaction mainly requires teachers to adopt better teaching support to effectively realize mutual understanding and support between teachers and students. In distance teaching, effect of teacher-student interaction mainly comes from effective support of teachers and students. Teachers use more scientific means to teach, and students use real-time replies to interact. Teachers should face up to the impact of teaching support (including platform and resources) on interaction between teachers and students, increase interaction frequency on distance teaching platform, constantly optimize teaching content of distance learning and enrich interactive teaching resources. Through monitoring function of distance teaching platform, they analyze learning behavior habits of adult learners, tap their potential learning interests, and promote learners to participate more in interaction between teachers and students. To master basic digital skills and tools, teachers should also change their way of thinking. Teachers need to fully borrow various resources supported by teaching to comprehensively improve learners' learning effect.

4.4 Difference analysis

The non-parametric test is used to test the difference of learning effect of whether they like distance education. It can be seen from Table 6 that whether they like distance education is composed of two groups (1.0 and 2.0). Therefore, Mann-Whitney test statistics are used for analysis. Whether they like distance education has a significant effect on learning effect (p<0.05).

Table 6. Non-parametric test analysis results

	Median (P25, P75)		**Mann-Whitney Test statistic U value**	**Mann-Whitney Test statistic Z value**	***p***
Learning effect	***1.0 (n=92)***	***2.0 (n=97)***			
	5.000 (4.0,6.0)	5.000 (3.0,5.0)	3666	-2.166	0.030*

* p<0.05 ** p<0.01

As it can be seen from Figure 1, learning effect of learners who like distance education is significantly higher than those who do not. Main reason is that in China, distance learning is more for adults. They apply for distance education because of life pressure, employment pressure, professional title evaluation, career development and other reasons. The learning style of adult learners is more fragmented and ubiquitous. Their learning motivation comes from environmental pressure (such as promotion and employment). Lack of internal learning motivation makes them lack learning efficacy, resulting in that the learning effect of adult learners who are reluctant to accept distance teaching is significantly lower than that of adult learners who are willing to accept distance teaching. Therefore, attention should be paid to enlightening distance learning managers to focus on distance learning motivation of adult learners, to timely introduce specialty and course of distance teaching at the beginning of enrollment, and to let them fundamentally accept distance teaching method, to improve their learning effect.

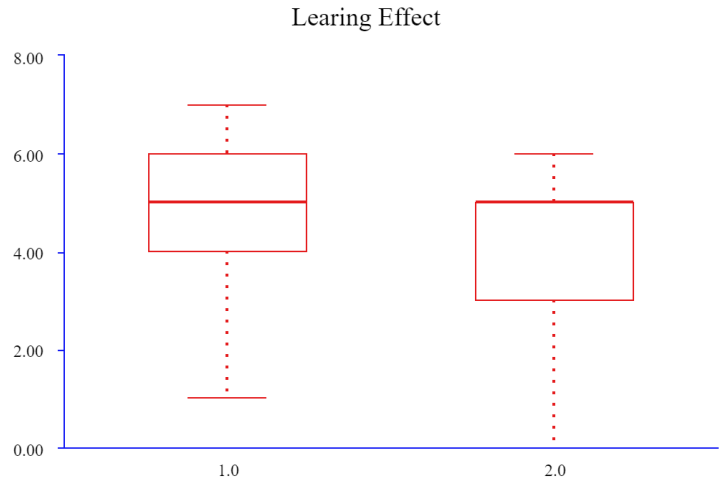

Fig. 1. Non-parametric test analysis results

5 Conclusion

Distance education can further liberate and optimize learners' space-time allocation, promote learners and teachers to produce higher quality interactive behavior, and improve learners' learning effect. Based on the CLASS as the questionnaire, this study analyzes the impact of teachers' and students' emotional support, class management and teaching support on students' curriculum teaching effect in distance education, and calculates difference between whether they like distance education and learners' learning effect. Conclusions are as follows: two aspects of teacher-student interaction (class management and teaching support) can significantly improve the learning effect of students in curriculum education. Whether they like distance education or not shows a significant effect on all learning effects. Learning effect of learners who like distance education is significantly higher than those who do not. Follow-up research may be carried out on two-way interaction between teachers and students, how to produce the effect, systematic comprehensiveness of learners with different learning bases' acceptance of distance teaching, establishment and improvement of curriculum teaching evaluation mechanism, and enhancing students' sense of acquisition and recognition of teaching content.

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