



Influence Factors of collaborative learning in a distributed learning environment

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Abstract: Collaborative learning in distributed learning environment is an important form of collaborative learning in the Web2.0 era. There are few studies on the influencing factors of collaborative learning in distributed learning environment in the process of promoting teaching reform using information technology. The research built the hypothesis of the research factors of the cooperative learning effect of distributed learning environment, and designed a questionnaire for college students from six factors, namely individual factor, teaching factor, environmental factor, organizational factor, interaction factor and distributed collaborative learning factor. The results showed that individual factor, teaching factor and distributed collaborative learning factor had a significant positive effect on the distributed collaborative learning. Environmental factor, organizational factor and interaction factor are variables with various influencing factors as independent variables. In the results of regression analysis of distributed collaborative learning effects for dependent variables, the overall regression effect reached a significant level. In addition, the paper put forward some suggestions from three aspects on the implementation of distributed collaborative learning based on the research findings.

Keywords: collaborative learning; Influence Factor; distributed learning environment

I. INTRODUCTION

Distributed learning is the development trend of future learning. Distributed learning In a broad sense, as long as the learner does not learn related content in a unique place, it can be regarded as distributed learning; narrowly distributed learning usually refers to distributed learning based on network. The distributed learning referred to in this paper is the former, and the distributed learning environment here refers to the theoretical and technical basis, and consists of two parts: the guest environment and the main environment. The object environment includes five aspects: network and hardware facilities, distributed learning support system, information resources, management and evaluation. The main environment mainly refers to students and teachers. A distributed learning environment can provide strong conditions for collaborative learning and provide strong support.

Collaborative learning is “all relevant behaviors in which students participate in small groups, achieve common learning goals, and maximize the cooperation between individuals and others in a certain incentive mechanism” [1]. Collaborative learning has become a learning model. On the one hand, it can develop individual students' thinking ability and enhance the communication ability between individual students. On the other hand, collaborative learning can improve students' learning performance and form students' critical thinking and innovation. Sexual thinking, the optimism of learning content and school, the ability of individual groups and their communication with members of society, the treatment of self-respect and the relationship of mutual respect between individuals have obvious positive effects. Collaborative learning has developed from the beginning to the present in a variety of forms of collaborative learning. Collaborative learning has also evolved from classroom to application to the entire social culture. This paper studies the collaborative learning effect and its influencing factors in a new distributed learning environment, paving the way for collaborative learning in specific contexts.

In the journal articles published by China Knowledge Network from 2001 to 2018, there are 127 articles in the title that contain “collaborative learning” and “influencing factors”. The titles also contain the documents of “collaborative learning” and “distributed learning environment”. There are 2 papers. There are only 7 influential factors of collaborative learning in a distributed learning environment. The overall trend of the literature is shown in Figure 1. It can be seen that the influencing factors of collaborative learning in the distributed learning environment are in the 20th century. In the early days, some scholars conducted research, but after 2006, there was a blank in the study. It was not until 2017 that some scholars began to study again.

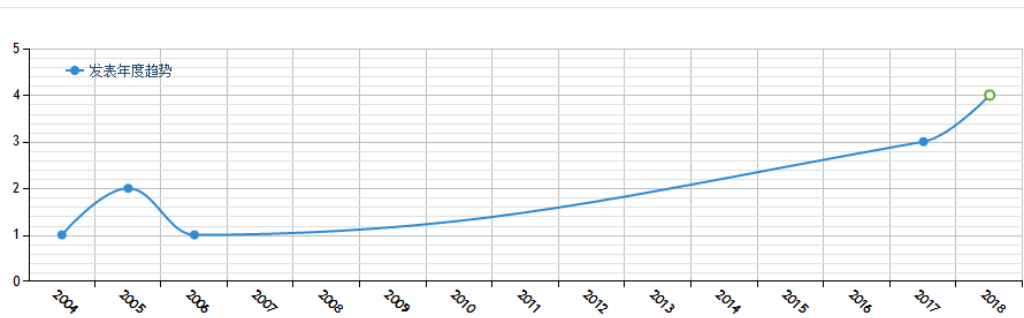


Figure 1 Analysis of the overall trend of the influencing factors of collaborative learning in a distributed learning environment Literature review

Research on collaborative learning has a long history. The founder of contemporary collaborative learning theory, Professor Johnson and others at the University of Minnesota in the United States believes that "collaborative learning is the use of groups in teaching to enable students to work together to maximize their own learning and others' learning [2]. Zhao Jianhua believes that collaborative learning is a strategy for organizing students to learn in groups or groups. It is usually composed of four basic elements: collaborative groups, members, tutors, and collaborative learning environments. It is divided into seven modes: competition, debate, cooperation, problem solving, partner, design and role-playing. [3] At the same time, foreign scholar Johnson & Johnson (2009) proposed five elements that are indispensable for successful collaborative learning, positive mutual Dependence, personal and group responsibilities, facilitative interaction, social skills, group self-adjustment skills [4].

The way of collaborative learning is gradually changing and developing with the development of technology. The collaborative learning supported by computer has evolved into network collaborative learning and online collaborative learning, and later evolved into hybrid collaborative learning research. Distributed learning environment in recent years. Collaborative learning is also emerging. With the development of higher education, the trend of increasing technological complexity in the inquiry course learning activities has gradually attracted the attention of scholars, such as the widespread dissemination and use of virtual learning environments (VLEs, Moodle, Blacokoard, etc.) and the use of Web 2.0 tools. Exploring the exploration of distributed learning environment [5]. In a distributed learning environment, a variety of information technology environments are employed and a variety of learning platforms and extended Web tools are integrated to support learning activities (especially collaborative learning) [6]. In this learning environment, collaboration is a very useful teaching method for creating knowledge construction, which has been widely disseminated by sociologists [7].

Through literature search, it is found that most scholars are studying the influencing factors of online and online collaborative learning. Qin Shixin [8] pointed out the impact on network collaborative learning through the analysis and synthesis of network collaborative learning research at home and abroad. It can be divided into teaching factors, technical factors, organizational factors and individual factors. The various factors are not isolated. But they cross each other and affect each other. Both Zhou Guolin [9] and Zhang Xiaoxia [10] have pointed out that the four aspects of teachers, students, collaborative environment and collaborative tasks are factors influencing online collaborative learning. Zhang Xiaoxia believes that teachers and students are the most basic influencing factors. Zhang Guolin also found through empirical research that teachers' use of texts

on the Internet to guide students' learning methods can not effectively improve the effectiveness of student collaboration. Zhang Jianwei [11] also conducted an empirical analysis of web-based collaborative inquiry learning based on the curriculum, and studied the influencing factors of network collaborative learning from the perspective of learners' characteristics. Finally, it pointed out that learners' online collaborative inquiry learning behavior and IT Skills and self-learning skills have a significant positive correlation. While the original [12] analyzes the influencing factors from the perspective of network and environment, he points out that the four factors that influence online collaborative learning in online teaching are the content and nature of the online course, the cultural background of the learner, The quality of the online learning environment and the guidance and evaluation of online learning. It can be seen that several factors of teachers, students, environment (including equipment and technology) and collaborative tasks in network collaborative learning can obviously affect the effect of collaborative learning.

Zhou Guolin [9] also pointed out that network-based collaborative learning also requires the designation of the leader. The setup of the leader is best combined with the constant leader and the rotation leader. The organizational ability and knowledge level of the leader will affect the collaborative performance of the group. The information technology capabilities of the team members can predict the team's collaborative results to some extent. Foreign scholars also choose to conduct research on organizational factors. Organizational factors mainly include factors such as group size, group composition, and control of collaborative communication. Australian psychologist Karau & Williams (1993) found that the collaborative inertia of team members was directly related to group size [13]. Research by American public communication experts Olaniran (1994) and Hathorn (2000) shows that mutual understanding among team members is conducive to collaborative communication and is helpful for evaluating collaborative contributions, but if there are too many commonalities among team members, the differences will be too small. It is not possible to generate enough arguments to form meaningful discussions, which is not conducive to the knowledge construction of collaborators [14][15]. American education expert Brush (1997) has shown that under the condition of collaboration, each member's responsibility encourages them to continuously learn knowledge, and collaboration enables them to continuously help other members to access new resources, promote the healthy development of collaborative communication, and maximize learning. However, if the collaborative members find that their work does not contribute to the group's performance, it is easy to create collaborative inertia, or gradually withdraw from collaboration [16]. Australian psychologist Karau & Williams (1993) found that in online collaborative learning, team members must feel that they have a unique contribution to the group's achievements, their efforts are recognized by the team members, collaboration will be effective, and the effect will be more positive. [17].

Yan Linting [18] used the combination of quantitative research and qualitative research to explore the influence of network collaborative learning effects, and constructed a model diagram of the relationship between network collaborative learning effects and influencing factors, including the internal influence factors of learners (self-efficacy, learning motivation), negative psychology) and external factors influencing the learning environment (learning leadership, learning community and learning resources), among the internal factors, self-efficacy and learning motivation have a significant positive impact on learning outcomes, and the former is more influential than the latter, negative Psychology has a significant negative impact on learning outcomes. Among the external influence factors, the learning community, learning resources, and learning leadership have a

significant positive impact on the learning effect, and the degree of influence reduces the learning community in turn, which is the most influential factor on the learning effect. In this study, the students' own factors were carefully divided, and the sub-factors of learning community and learning resources were added.

In addition, many scholars have studied the influencing factors of collaborative learning from different perspectives. For example, Bai Xiaojing and Xu Xiaodong [19] analyzed from the perspective of factors affecting intercollegiate collaborative learning. They pointed out that they affect intercollegiate collaboration. There are many factors in learning, which are mainly divided into three factors: student's own factors, technical support, social and environmental aspects, and finally put forward nine suggestions for the school level. Feng Xue [20] is a comparative study of different learning groups from the perspective of the learning effects of the network learning community, from the three aspects of learning content, technology and social, pointing out that the network education college not only provides students with independence. Learning teaching materials ensure that the platform system runs smoothly, and also provide students with guidance on network language learning methods and communication skills training. Zhang Wei [21] analyzes the influencing factors of computer-aided collaborative language learning. She points out that in the second language teaching, the learner's emotional state (emotion refers to the learner's feelings, feelings, emotions, attitudes during the learning process). Etc.) directly affect their learning behavior and learning outcomes.

Through the research of scholars before, it is not difficult to find that the number of students' own factors, teachers' factors, teaching factors, technical factors, organizational factors, environmental factors and skill factors are many times, which will affect the effect of collaborative learning. At present, the research on various influencing factors is scattered, and there is no unified view. A systematic hypothesis model is not established. Based on the literature review and the distributed learning environment, this study proposes six hypotheses about the influencing factors of collaborative learning, namely, individual factors, teaching factors, environmental factors, organizational factors, interaction factors and distributed collaborative learning factors, to build distributed collaborative learning. Influencing factors hypothesis model to explore the key elements and mechanisms that affect collaborative learning.

Table 1 Summary of Influencing Factors of Collaborative Learning

| Author | Teacher factor | Student factor | Teaching factor | Technical factor | Organizational factor | envirmmental factor | Skills and other factors |
|---------------|-----------------------------|---|--|---|--|---------------------|---|
| Zhang Xiaoxia | teacher | student | Collaborative task | | | | |
| Qin Shixin | Individual factor (teacher) | Individual factor (student) | Teaching ideas Teaching methods design of teaching process | Technology, equipment, resources | Group size Group composition group communication | | Technical training |
| Zhou Yuanlin | Teacher (guidance) | Motivation, Attitude, Interest, Responsibility and Ability, | Collaborative task | Students' Information Technology Capabilities | Team leader's settings and capabilities | | Learners' personal communication skills |
| Zhang Jianwei | | IT skills, self-learning skills | | | | | |

| | | | | | | | |
|--------------|--|---|---|-----------------------|--|--|--|
| Lv Yuan | Guidance and evaluation of online learning | | The content and nature of the online course | | | Cultural background, quality of online learning environment | |
| Zhao Jianhua | | Motivating and motivating students to participate in collaborative learning | | | The results of the group study, the role of the team members | Collaborative learning place (adapt to the web environment) | The duration of collaborative learning, the skills of collaborative learning |
| Karau | | | | | Group size and group inertia | | |
| Yu Linting | | Self-efficacy, learning motivation, negative psychology | | Technical Support | | Learning leadership, learning community and learning resources | |
| Xu Xiaodong | | Student's own factors | | | | Society and environment | |
| Feng Xue | | | Learning Content | Technology (platform) | social interaction | | Provide training in learning guidance and communication skills |

III. Research design and process

A. *research method*

The research mainly uses literature research methods and survey research methods. Firstly, through literature review, the main factors affecting learner collaborative learning in distributed learning are determined. Through questionnaire survey, a universal survey and understanding of college students' collaborative learning in distributed learning environment is made, and the impact is measured. The six dimensions of the student's individual, teaching, environment, organization, interaction and distributed collaborative learning are studied. The research hypotheses are tested one by one according to the measurement results, and the hypothesis of the influencing factors of the collaborative learning environment collaborative learning effect is revised. Among them, data analysis is completed by SPSS software. The specific methods used in data analysis are: internal consistency reliability test, structural validity analysis, descriptive statistics of mean and standard deviation, correlation analysis and linear regression analysis.

B. *Hypothesis basis and research hypothesis*

Through the review and analysis of the literature related to the influencing factors of collaborative learning in distributed environment, it is found that students' own factors such as motivation, attitude, interest, responsibility and personal ability are the internal factors of student collaborative learning, and are the fundamental source of motivation to stimulate students' learning. It has a great impact on collaborative learning. In distributed learning, teaching factors mainly include teacher factors and factors of curriculum teaching. This factor creates a good learning platform for students, inspires students' thinking, organizes and distributes educational resources, and distributes in the process of discussing problems with students. The smooth progress of learning and the efficient construction of knowledge by learners are inseparable from the assistance of teaching factors. Therefore, the influence of teaching factors is very important. Distributed learning is a process of collaborative mutual assistance. Social constructivism theory believes that learners construct knowledge through interpersonal interaction and knowledge sharing with

learning partners. In this process, the group organization formed a good interaction, on the one hand, the learner has a sense of belonging, stimulating the enthusiasm of the learners, on the other hand, let the learners jump out of the mindset, absorb the different opinions of the peers, and carry out the self. Knowledge reconstruction, which promotes collaborative knowledge construction, shows that organizational and interaction factors also have a great impact on collaborative learning. The learning view of situational cognition theory believes that learning takes place in the environment. The environment is an important way for learners to make meaningful learning. It is very important for the acquisition of learners' knowledge. The learning environment has an important impact on collaborative learning. In addition, communication skills, technical training, collaborative learning skills and training, and the length of collaborative learning will also affect the effectiveness of collaborative learning. Based on the above theoretical basis, propose research hypotheses.

Table 2 Research hypotheses

| Numbering | Research object | Research hypothesis |
|-----------|---|---|
| H1 | Student individual factor | Individual student factors have a significant impact on collaborative learning in a distributed learning environment |
| H2 | Teaching factor | Teaching factors have a significant impact on the collaborative learning effectiveness of distributed learning environments |
| H3 | environmental factor | Environmental factors have a significant impact on the collaborative learning of distributed learning environments |
| H4 | Organizational factor | Organizational factors have a significant impact on the collaborative learning effectiveness of distributed learning environments |
| H5 | Interaction factor | Interaction factors have a significant impact on the collaborative learning effectiveness of distributed learning environments |
| H6 | Distributed collaborative learning itself | Distributed collaborative learning itself has a significant impact on the collaborative learning of distributed learning environments |

C. Research tools and research variables

Based on the literature review, this paper refers to the influential factor model of collaborative learning constructed by Yan Linting [23], and draws on the collaborative learning research scale compiled by Wang Youmei [24] and the knowledge construction in the teacher virtual learning community compiled by Li Wei. Influencing factors questionnaire [25], compiled a questionnaire on the factors influencing the collaborative learning environment collaborative learning. There are 11 major items in the questionnaire, the first 5 items are the basic information of the investigators, and the last 6 items are measured by the Likert 5-point scale, including individual factors, teaching factors, environmental factors, organizational factors, Interaction factors and factors of distributed collaborative learning itself. Therefore, the independent variables in the study are several factors of individual student, teaching, environment, organization, interaction and self. The dependent variable is the collaborative learning effect in the distributed learning environment.

D. Research objects and data samples

The research is based on the students of the first grade of the education technology major of South China Normal University. The research is based on the collaborative learning activities in the course of "Learning Science and Technology". Computer, Learning, WeChat, etc. are used as collaborative learning platforms. The 30 people who participated in the survey conducted a total of 30 questionnaires and 26 valid questionnaires. The effective recovery rate was 86.7%, of which 7.14% were boys and 92.86% were girls, which was in line with the distribution of males and females in the normal university. In the basic situation survey, the students' collaborative learning time was less than 5 hours per week, accounting for 85.71%, and over 5 hours, accounting for 14.29%. The frequently used equipments were computers and mobile phones, all of which exceeded 85%. The most frequently used collaborative

learning platform It is WeChat, reaching 92.86%, followed by learning pass, QQ, and graphite documents, all accounting for less than 40%.

IV. Analysis of research results

A. Reliability and validity analysis of the scale

Although the questionnaire was designed with reference to some relatively mature questionnaire scales, after a small sample test, modification and improvement, in order to ensure the reliability and validity of the research conclusions, the reliability of the questionnaire before the data analysis The validity was tested separately. In this study, the internal consistency reliability test method was used to test the reliability of the network collaborative learning effect scale. The test results showed that the Cronbach's α value was 0.977, indicating that the internal consistency of the measurement scale is very good and the reliability is high. The measurement results are reliable. The factor analysis method was used to analyze the structural validity of the questionnaire, and the components with too few items were excluded. The test results showed that the KMO value was 0.701, the Bartlett's spherical test value was 638.016, the degree of freedom $df=190$, and the significance probability $Sig. = 0.000$, which shows that the questionnaire has good structural validity.

B. Analysis of the Correlation between the Factors and the Cooperative Learning Effect of Distributed Learning Environment

According to the literature research, the factors of individual factors, teaching factors, environmental factors, organizational factors, interaction factors, and distributed collaborative learning itself have a strong influence on the collaborative learning effect. This research uses SPSS statistical analysis software to adopt the Pearson product difference correlation method to analyze the correlation coefficient of the above six influencing factors on the collaborative learning environment collaborative learning effect, as shown in Table 3.

Table 3 Correlation analysis results of collaborative learning environment and its influencing factors in college students' distributed learning environment

| Dimension | 1 | 2 | 3 | 4 | 5 | 6 |
|--|--------|--------|--------|--------|--------|---|
| 1. Individual factors of students | 1 | | | | | |
| 2. Teaching factors | .903** | 1 | | | | |
| 3. Environmental factors | .871** | .877** | 1 | | | |
| 4. Organizational factors | .803** | .760** | .815** | 1 | | |
| 5. Interaction factors | .789** | .799** | .868** | .851** | 1 | |
| 6. Distributed collaborative learning itself | .629** | .581** | .713** | .696** | .716** | 1 |

Note: 1)** $P < 0.02$;

2) Two-tailed test

According to the results of Table 2, it can be seen that the individual factors of students, teaching factors, environmental factors, organizational factors, interaction factors, and distributed collaborative learning are all significantly related to the collaborative learning effect. The correlation coefficient is in the range of 0.581-0.903. There is also a significant correlation between the various influencing factors.

C. Regression analysis between six factors and collaborative learning environment in distributed learning environment

According to relevant analysis, it can be seen that students' individual factors, teaching factors, environmental factors, organizational factors, interaction factors, and distributed collaborative learning itself have certain correlations with collaborative learning effects, but whether there is causality between them. Relationships and what kind of causal relationship, whether the assumption is true, also need to use regression analysis for further exploration and verification. This research adopts the linear regression analysis method and judges by DW test value. When the DW value is in the range of 1.5-2, it indicates that the residual term is irrelevant, and regression analysis can be performed.

It is judged whether the regression equation is significant by the F value and the F probability value, that is, whether the linear relationship between the dependent variable and the independent variable is judged significantly at the overall level, and the independent variable R² is used to explain the independent variable to the dependent variable. Predictive power, judging the significance of each independent variable by the T value of the regression coefficient and the significance of T, and judging the influence degree of the influencing factor by standardizing the regression coefficient, the larger the B value, the greater the degree of influence. The distributed collaborative learning effect was used as the dependent variable, and the individual factors, teaching factors, environmental factors, organizational factors, interaction factors, and distributed collaborative learning itself were used as independent variables for regression analysis, as shown in Table 4.

表4 六项影响因素对分布式协作学习效果的回归分析结果

| Independent variable | DW value | F value | Significant F value | R ² | T value | T值的显著性 | B值 (标准化回归系数) |
|----------------------|----------|---------|---------------------|----------------|---------|--------|--------------|
| 学生个体因素 | 1.798 | 29.762 | 0.000 | 0.951 | -4.927 | 0.000 | -0.063 |
| 教学因素 | | | | | -1.792 | 0.089 | -0.019 |
| 环境因素 | | | | | 1.117 | 0.278 | 0.017 |
| 组织因素 | | | | | 0.922 | 0.368 | 0.011 |
| 交互因素 | | | | | -1.307 | 0.207 | -0.021 |
| 分布式协作学习本身 | | | | | 3.148 | 0.005 | 0.059 |

The results in Table 3 show that the DW value is 1.798, which is close to 2, indicating that there is no correlation between the residuals. Regression analysis can be performed. R² is 0.951, indicating that the combined explanatory variables of the six factors are 95.1%, and the degree of influence is from large to small. Individual factors, distributed collaborative learning itself, interaction factors, teaching factors, environmental factors, and organizational factors. According to the significance of the T value, the regression coefficient of the two dimensions of the student's individual factors and the distributed collaborative learning itself to the cooperative learning effect passed the significant test of 0.01 level. The regression coefficient of the teaching factor to the cooperative learning effect is close to 0.05 level. Significantness test, it can be seen that these three factors have a significant impact on the effectiveness of distributed collaborative learning, so it is assumed that H1, H2, and H6 are verified, that is, individual factors of students, teaching factors, and distributed collaborative learning itself for distributed collaborative learning. The effect has a significant impact. In addition, the significance of environmental factors, organizational factors and interaction factors is not obvious, and then the specific indicators of each item are subjected to regression analysis.

D. Regression analysis between environment, organization, interaction factors and collaborative learning environment

In order to further determine the causal relationship between variables in environmental, organizational and interaction factors and distributed collaborative learning, this study takes the variables of each influencing factor as independent variables and the distributed collaborative learning effect as the dependent variable for regression analysis. The relationship between various influencing factors and distributed collaborative learning.

1) Relationship between environmental factor dimension and distributed collaborative learning

In the dimension of environmental factors, in addition to the mean value of the environment construction is less than the median value, the learner's affirmation level for other items is close to the middle value of the five-point scale of 2.5, which reflects that the learner's influence on the environment construction is not complete. Certainly, it can be seen that when the learners are engaged in distributed collaborative learning, the requirements for the environment are not very strict. It is believed that factors such as learning platform, learning equipment, learning place and social

atmosphere affect the effect of distributed collaborative learning to a certain extent. The results of linear regression analysis (see Table 5) show that the overall regression effect of environmental factors on distributed collaborative learning has reached a significant level ($R^2=0.537$, $F=4.630$, $P=0.006$), so H3 is assumed to be validated. However, these aspects of environmental factors have no significant impact on distributed collaborative learning ($Sig.>0.05$). That is to say, in the distributed collaborative learning, learners have weaker influences on environmental factors, but In addition to environmental construction variables, learning platforms, equipment, places and social atmosphere have a certain weak influence.

表5 环境因素与分布式协作学习效果的回归分析结果

| 自变量 | DW 值 | F 值 | F 值的显著性 | R^2 | T 值 | T 值的显著性 | B 值 (标准化回归系数) |
|------|-------|-------|---------|-------|--------|---------|---------------|
| 环境构建 | 1.000 | 4.630 | 0.006 | 0.537 | -1.018 | 0.321 | -0.338 |
| 学习平台 | | | | | -0.458 | 0.652 | -0.217 |
| 学习设备 | | | | | -0.118 | 0.907 | -0.036 |
| 学习场所 | | | | | -0.647 | 0.525 | -0.182 |
| 社会氛围 | | | | | -0.180 | 0.859 | -0.051 |

2) Relationship between organizational factor dimension and distributed collaborative learning

In the organizational factor dimension, the statistical results show that, except for the mean value of the group leader's influence, which is almost the middle value, the learner's affirmation level for other items is lower than the middle value of the five-point scale of 2.5, which shows that the learner feels the organizational factor. Whether the effect of distributed collaborative learning has a significant impact is not certain. The mean value of the leader factor indicates that the influence of the leader factor on distributed collaborative learning is recognized by everyone. The results of linear regression analysis (see Table 6) show that the overall regression effect of organizational factors on distributed collaborative learning has reached a significant level ($R^2=0.454$, $F=4.370$, $P=0.010$), so H4 is assumed to be validated. However, these aspects of organizational factors have no significant impact on distributed collaborative learning ($Sig.>0.05$). That is to say, learners in the distributed collaborative learning, the influence of organizational variables is weak, in the group The influence of the leader as a leader on the learners is more obvious.

表6 组织因素与分布式协作学习效果的回归分析结果

| 自变量 | DW 值 | F 值 | F 值的显著性 | R^2 | T 值 | T 值的显著性 | B 值 (标准化回归系数) |
|------|-------|-------|---------|-------|--------|---------|---------------|
| 组长影响 | 1.369 | 4.370 | 0.010 | 0.454 | -0.536 | 0.597 | -0.037 |
| 角色扮演 | | | | | -1.765 | 0.092 | -0.160 |
| 学习成果 | | | | | -0.860 | 0.400 | -0.080 |
| 人员构成 | | | | | 0.668 | 0.511 | 0.069 |

3) Relationship between interaction factor dimension and distributed collaborative learning

In the dimension of interaction factors, the statistical results show that the affirmative level of each item of the learner's interaction factors is lower than the middle value of the five-point scale of 2.5, which reflects that the learner's influence on the interactive factors is not so effective. Recognition, it can be seen that in the distributed learning environment, the interaction of the network is not significant for collaborative learning. The results of linear regression analysis (see Table 7) show that the overall regression effect of organizational factors on distributed collaborative learning has reached a significant level ($R^2=0.530$, $F=5.924$, $P=0.002$), so H5 is assumed to be validated. However, in addition to the interaction mode ($Sig.<0.05$), the other aspects of organizational factors have no significant impact on distributed collaborative learning ($Sig.>0.05$), that is, learners are engaged in distributed

collaborative learning. The variables of the interaction factors have weak influence, but the face-to-face communication and timely response exchanges have reached a significant level.

表7 交互因素与分布式协作学习效果的回归分析结果

| 自变量 | DW 值 | F 值 | F 值的显著性 | R ² | T 值 | T 值的显著性 | B 值 (标准化回归系数) |
|------|-------|-------|---------|----------------|--------|---------|---------------|
| 交互方式 | 1.246 | 5.924 | 0.002 | 0.530 | -2.380 | 0.027 | -0.180 |
| 成员交流 | | | | | -0.181 | 0.858 | -0.017 |
| 及时回复 | | | | | -0.822 | 0.420 | -0.055 |
| 交互体验 | | | | | -0.164 | 0.871 | -0.011 |

V. Research conclusions and recommendations

A. Analysis conclusion

The factors affecting the collaborative learning effect of distributed environment include the individual dimensions of students, teaching factors, environmental factors, organizational factors, interaction factors, and distributed collaborative learning factors. The size of the influence is the individual factors of students, distributed collaborative learning. Itself, interaction factors, teaching factors, environmental factors and organizational factors. Among them, the three dimensions of student individual factors, teaching factors and distributed collaborative learning have a significant impact on the effectiveness of distributed collaborative learning. Environmental factors, organizational factors and interaction factors are variables with different influencing factors as the independent variables. In the results of the regression analysis of the dependent variable effect, the overall regression effect reached a significant level. In the individual factor dimension of students, their own learning motivation, learning interest, learning style and attitude towards collaborative learning have a significant impact on distributed collaborative learning. In the dimension of teaching factors, the guidance of teaching assistants, the encouragement of teachers, thematic tasks The design, the evaluation of homework, the teaching methods of teachers, and the provision of learning resources have a significant impact on distributed collaborative learning. In the dimension of distributed collaborative learning itself, the length of collaborative learning and the training of collaborative learning skills have significant influence. In the dimension of environmental factors, the influence of each variable is weak, but in addition to the environmental construction variables, the learning platform, equipment, place and social atmosphere have a certain influence; in the organizational factor dimension, the influence of each variable in the group is weak in the group. The role-playing in the group has a significant impact. The role of the team leader in the group will obviously affect the effect of distributed collaborative learning. In the dimension of interaction factors, the influence of each variable is weak, but the face-to-face communication and timely response exchanges reach a significant level, indicating that in collaborative learning, learners need more Communication and feedback, learner prefer to interact face to face.

B. Implementation advice

Through analysis, suggestions for implementing distributed collaborative learning can be proposed from three aspects: teacher, teaching and organizational interaction, in order to improve the effect of collaborative learning in distributed learning environment.

1) Teacher dimension

In terms of teachers, teachers play the role of leadership, carry out distributed collaborative learning skills and methods in advance, encourage and guide students' collaborative learning, improve students' self-learning ability and collaborative learning ability in the process of distributed learning; It is easy to produce the theme of the activity of the learner's resonance. In the number of activities, it can not increase the burden of the students too much, nor can it make the study boring and boring, encourage the learners to carry out thematic and inquiry-based collaborative learning, stimulate the

learning motivation, provide resources and Intellectual support to explore the potential of learners. When the learner encounters difficulties, give play to the guiding role of the teaching assistant, give positive feedback, provide directional advice to the learner, and avoid the student trek.

2) *Teaching dimension*

In terms of teaching, first of all, let learners recognize the importance of completing the task of learning, personal value and social value. Secondly, to clarify the learning objectives, the learning process is guided by the learning objectives, and the learning objectives directly affect the motivation of the learners' emotion. Specific goals can drive learning behavior and increase learners' willingness to participate. Thirdly, providing sufficient learning resources, creating appropriate situations, stimulating students' interest and motivation in real and reasonable situations is conducive to collaborative learning; finally, developing a reasonable and effective evaluation system, not only for students' learning outcomes. Inspection and evaluation, while conducting a process evaluation of the collaborative learning process, and regulating the collaborative learning approach.

3) *Organizational interaction dimension*

In terms of organizational interaction, the peer evaluation mechanism and the mechanism of the rotation leader are added to increase the participation of the observer. At the same time, the heterogeneous grouping is used to group the members of the learning community in a heterogeneous grouping manner to promote the generation of cognitive conflicts. Activate the learner's cognitive structure, promote mutual learning and complement each other, so that students with good grades can have a high sense of identity, and students with relatively weak results can also feel positive incentives.

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