

An Empirical Study on the Influencing Factors of University Teachers' Teaching or Scientific Research Cooperation among the Learning Community

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Abstract: The empirical research revolves around the influencing factors of university teachers' teaching or scientific research cooperation through conditional probability. The following significant conclusions are drawn: (1) There is no significant difference in the understanding of team assistance among university teachers based on their gender and age. Most teachers recognize the promoting effect of peer assistance on the team and crave to improve their personal level and performance through team assistance; (2) Teachers in humanities tend to work hard individually, while those in sciences tend to work in teams; (3) Teachers of different types of teaching and research work exhibit significant differences in their behavior in peer assistance. As team leaders, they should form a "peer assistance" teaching and research team based on the principle of matching; (4) The role of peer assistance in the development and growth of teachers is related to personalized factors such as their personality, growth experience, and professional field, as well as external factors such as organizational culture, university systems, and cooperation opportunities. If schools provide substantial guidance and support, it can improve the performance of peer assistance teams.

Keywords: Learning Community; Collaborative Research in Teaching or Research; Influencing Factors; Empirical Analysis

1. Introduction

The meaning and value of "peer assistance" in learning communities Parker Palmer (2005) pointed out in his book

"Courage in Teaching-Strolling the Teacher's Mind" that "there is no formula for high-quality teaching in the world, and expert guidance can only be a drop in the bucket. If we want to grow in practice, we have two places to go: one is to reach the inner world of high-quality teaching, and the other is a community composed of peers. From colleagues, we can understand ourselves and our teaching more." This sentence points out the important role of the teacher learning community in the professional growth process of teachers [1].

A learning community refers to a group composed of learners and their assistants (including teachers, experts, tutors, etc.) who frequently communicate and exchange with each other during the learning process, share various learning resources, and work together to complete certain learning tasks. As a result, interpersonal connections that influence and promote each other are formed among members. Simply put, a learning community is a group of people gathered together to communicate, collaborate, learn a certain knowledge, and complete a learning task.

The key to the existence and development of a learning community is "peer assistance" among its members. The so-called "peer assistance" learning community refers to a group of teachers who pursue self-identity and self-improvement, voluntarily come together to discuss common problems in teaching and research, actively cooperate to form an equal and trustworthy learning community. Within the community, teachers with certain teaching experience or academic achievements take the initiative to take on the responsibility and organize everyone to form partnerships. Firstly, through joint reading, discussion,

demonstration teaching, and lesson study, especially through systematic observation and feedback, they learn and share new knowledge with each other, improve teaching strategies, and thereby improve teaching quality and promote their professional development; Secondly, a teaching and research team is formed through division of labor and cooperation in project applications, research topics, paper writing and publication, social research, and social services (rural revitalization teams) around key and difficult issues in teaching, professional construction, disciplinary development, and technological innovation. Its main characteristics include promoting research through education, equal consultation, cooperation and mutual assistance, and win-win development.

In the context of the COVID-19, online teaching has been widely carried out. The learning community among teachers has broken through the conflict of interest between offline colleagues. On the contrary, online reading conferences, online training, online classes and research conferences have broken through the restrictions of time and space, and closely related to knowledge sharing, opinion collision and peer assistance among teachers. This article explores the attitudes and behavioral patterns of university teachers towards peer assistance through market research and empirical analysis, and proposes ideas and strategies to promote the role of peer assistance in the development of university teachers.

2. A Questionnaire Survey on "Peer Coaching" among the Learning Community of University Teachers

Table 1. Distribution of Basic Information of Surveyed University Teachers

Professional type	School type	male	female	Total
science	higher vocational colleges	64	64	128
	Higher undergraduate institutions	15	37	52
liberal arts	higher vocational colleges	76	191	267
	Higher undergraduate institutions	34	102	136
Total		189	394	583

The survey found that mutual assistance is often a personal behavioral preference of teachers, with obvious personal characteristics. There is no clear correlation between individual achievements and whether or not they participate in team interaction. People carry out team mutual assistance for multiple

The learning community is the foundation and carrier of peer assistance among teachers. Conducting peer assistance among teachers requires internal needs and external conditions, and internal needs are the most essential driving force for conducting mutual assistance.

2.1 Implementation Status of Questionnaire Survey

In 2017, the research group of the "Peer Assistance Excellent Teaching and Research Team Construction" of the innovation team in ordinary universities in Guangdong Province conducted a "Survey on Teaching and Research Cooperation among University Teachers" from 2019 to 2021. The survey questionnaire was distributed and collected using QuestionStar, and teachers completed the data collection by logging in to QuestionStar through tools such as mobile phones, computers, and PADs. The investigation started in January 2019 and ended in July 2021, lasting for 2.5 years. Through meetings, work groups, and friend recommendations, 583 teachers from over 50 undergraduate and vocational colleges across the country completed the questionnaire effectively.

According to the analysis of the collected survey questionnaires, based on the type of institution in which the respondents work, 395 survey questionnaires were from vocational colleges and 188 survey questionnaires were from undergraduate colleges. Among them, there are 189 male teachers and 394 female teachers; 180 people are in science majors, and 403 people are in humanities categories. The relationship between them is shown in Table 1.

purposes, and organizational behavior is more about reflecting the establishment of mechanisms for peer mutual assistance.

2.2 Analysis of the Authenticity of the Data Collected from the Questionnaire.

The analysis of the authenticity of data comes

from the distribution of questionnaire IP addresses, login times, and completion times, as well as the analysis of the relationship between survey data. The real data should be completed by independent individuals, without any correlation in time, location, or choice of questions. The time distribution of completing the questionnaire is close to a normal distribution, and the analysis and statistical techniques used are non parametric Kolmogorov Sminov tests and run length analysis.

According to the analysis of login IP, there are 123 records with duplicate IPs, and only 34 have the same access method. They all have the same school type and IP location, which can be considered as logging into the website through a dedicated IP address within the school. Therefore, the same IP address is displayed. Combined with gender, age, professional title and other data, the possibility of duplicate input can be ruled out.

There are a total of 25 questions in this survey, among which questions 1-5 are gender, college type, major classification, professional title, and age, which belong to the personal information of the respondents. Questions 6-8 and 10-22 are multiple-choice questions, and question 9 is a single choice question. For multiple choice questions, each option is independently judged by the respondent and can only be chosen or not chosen (represented by 1 and 0). Therefore, the option for the problem can be identified as a Bernoulli variable, such as selecting frequency p for 1, frequency $1-p$ for 0, and variance $p(1-p)$.

On the other hand, each problem of multiple choice can be viewed as a sequence composed of 0s and 1s, which may appear consecutively in segments of 00...0 or 11...1. This continuous segment of 0s or 1s is called a run, so the number of runs can be used to test the randomness of the sample or the distribution characteristics of the population.

Through single sample run analysis using SPSS for all multiple-choice problems, all choices 0 and 1 are distributed as random sequences, with Sigma levels ranging from 0.12 to 0.95 and run numbers ranging from 35 to 450. There is no lack of sample independence or systematic convergence behavior.

The above analysis indicates that the independence, representativeness, and

authenticity obtained from the survey are not a problem. The conclusion drawn from the data analysis is that the surveyed teacher group has commonality and universality [2].

2.3 Consistent Analysis of Data Collected from Questionnaires

In the survey, it is required to have consistency in the results of multiple surveys for the same respondent, but in reality, it is not possible to conduct multiple repeated surveys on the respondent. Therefore, the reliability of the data is analyzed by measuring internal consistency. The method is to use the number of choices for each multiple-choice question as the value of the question, and Cronbach's method is adopted α the coefficient measures internal consistency, and the calculation formula is:

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum \sigma_i^2}{\sigma_y^2} \right) \quad (1)$$

Among them, is the variance of each multiple-choice question, is the overall variance, which is equal to the sum of all multiple-choice questions and their covariance; the proportion of common variance caused by latent variables, where k is the number of multiple choice questions in the same analysis area.

Used for Cronbach's α the question on the coefficient survey questionnaire is: What are the current problems encountered in teaching, the challenges faced in scientific research, how do you generally solve the above problems in teaching and scientific research, how do you unite team members in team cooperation if you are a team leader, and how do team members promote team cooperation? These 17 questions were analyzed using SPSS 19, Cronbach's α The value is 0.885. According to the reliability criterion ($0.70 < \text{reliability} \leq 0.90$ is very reliable), the questionnaire in this survey is very reliable [3].

3. Empirical Analysis of the Influencing Factors of Collaborative Research Conducted by Teachers in Teaching or Scientific Research

Teaching or research collaborative research projects are a form of peer assistance among university teachers. It is worth investigating whether this cooperation is influenced by other forms of peer assistance, such as face-to-face

discussions and study groups. In this survey, the "Teaching or Research Collaborative Research Project" option (represented by A) was combined with four conditions: "Shared Network Platform" (represented by B), "Guidance from Senior Experts or Teachers in Professional Fields" (represented by C), "Special Discussion, Textbook Recommendation Meeting or Academic Conference" (represented by D), and "Master Apprentice Pairing, Old Teachers Leading New Teachers" (represented by E), How to evaluate the impact of the other four factors on "teaching or research collaborative research projects" when forming a multiple-choice question that includes "what do you think are the ways for teachers to help each other"? We analyze it through conditional probability.

P (A) represents the frequency of teachers choosing "teaching or research collaborative research projects";

P (A/B) represents the frequency of selecting "teaching or research collaborative projects" among teachers who have chosen "shared network platforms";

P (A/B/C) represents the frequency of selecting "teaching or research cooperation projects" among teachers who have chosen

"shared network platforms" and "guidance from senior experts or teachers in professional fields";

P (A/B/C/D) represents the frequency of selecting "teaching or research cooperation projects" among teachers who have chosen "shared network platforms", "guidance from senior experts or teachers in professional fields", and "thematic discussions, textbook recommendation meetings or academic conferences";

P (A/B/C/D/E) represents the frequency of selecting "teaching or research cooperation projects" among teachers who have chosen "shared network platforms", "guidance from senior experts or teachers in professional fields", "thematic discussions, textbook recommendation meetings or academic conferences", and "mentorship, old teachers leading new teachers";

The changes in the number of people choosing the frequency of "teaching or research cooperation projects" under different conditions are shown in Table 2. B1 indicates that "shared network platforms" are selected, and B0 indicates that they are not selected. As the conditions increase, the number of teachers who meet these conditions decreases [4].

Table 2. Changes in the Number of People Selecting Various Options under Different Conditions

Each option	B	C	D	E	A	TOTAL
unconditional	431	437	444	351	432	583
No shared network platform selected	B ₀	92	98	72	107	152
	B ₀ ∧C		61	48	64	92
			B ₀ ∧C∧D	35	35	61
				B ₀ ∧C∧D∧E	26	35
Choose a shared network platform	B ₁	345	346	279	325	431
	B ₁ ∧C		298	245	259	345
			B ₁ ∧C∧D	229	251	298
				B ₁ ∧C∧D∧E	212	229

The conditional probability change of A is shown in Figure 1. The conditional probability change of A remains around 0.7 under three conditions: A, A∧B_i, and A∧B_i∧C, indicating that B, C, and A are independent and do not affect each other's choices; However, after the introduction of conditions D and E, the probability of condition A changes significantly, indicating that "shared network platforms" and "guidance from senior experts or teachers in the professional field" do not affect the selection of "teaching or research cooperation projects" by teachers. However,

"special topic discussions, textbook recommendation meetings or academic conferences" and "teacher apprentice pairing, old teachers leading new teachers" have an impact on the selection. The reasons require further observation and research.

The analysis also indicates that B₁∧C∧D∧E is also the best condition for teachers to choose "teaching or research cooperation research projects", under which the probability of A occurring is the highest, at 92.6% [5].

4. Are Face-to-face Discussions between

Teachers Influenced by Other Factors?

"Face to face discussion" (represented by FF) is a communication channel for mutual assistance among teachers and peers. Other channels include "QQ or WeChat" (represented by OL), "learning groups" (represented by TW), "thematic discussions" (represented by GD), etc. Whether these channels affect teacher face-to-face discussions can also be analyzed through

changes in conditional probability [6]. The impact of "QQ or WeChat" on "face-to-face discussions" can be divided into two situations: using QQ or WeChat or not using QQ or WeChat, represented by OL (+) and OL (-) respectively, and other conditions are also represented using similar methods. The calculation of conditional probabilities for face-to-face discussions under different conditions in the survey is shown in Table 3.

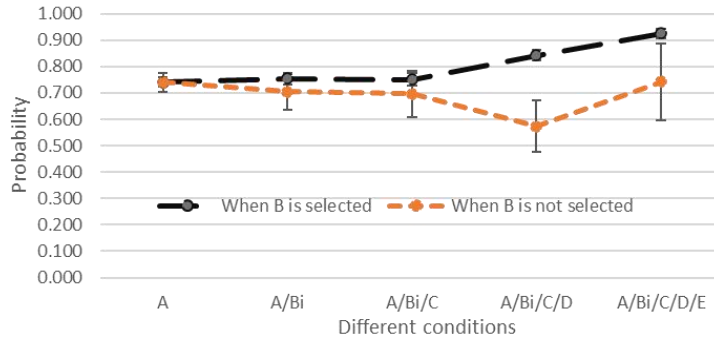


Figure 1. Changes in the Probability of Selecting "Teaching or Research Cooperation Research Projects"

Table 3. Conditional Probability of Choosing Face to Face Discussions under Different Conditions

condition	Select the number of people to conduct face-to-face discussions	Number of people who choose not to conduct face-to-face discussions	total	The conditional probability of selecting face-to-face discussions
Unconditional restrictions(NC)	543	40	583	0.931
OL(+)	424	23	447	0.949
OL(+)/TW(+)	325	12	337	0.964
OL(+)/TW(+)/GD(+)	284	7	291	0.976
OL(-)	119	17	136	0.875
OL(-)/TW(+)	71	9	80	0.888
OL(-)/TW(+)/GD(+)	59	8	67	0.881
OL(-)/TW(-)	48	8	56	0.857
OL(-)/TW(-)/GD(+)	28	8	36	0.778
OL(-)/TW(-)/GD(-)	20	2	22	0.909

From the relationship between conditions, there are four conditional chains: NC→OL(+) \rightarrow OL(+)/TW(+) \rightarrow OL(+)/TW(+)/GD(+)(Abbreviated as the first conditional chain), NC→OL(-) \rightarrow OL(-)/TW(+) \rightarrow OL(-)/TW(+)/GD(+)(Abbreviated as the second conditional chain), NC→OL(-) \rightarrow OL(-)/TW(-) \rightarrow OL(-)/TW(-)/GD(+)(Abbreviated as the third condition chain), NC→OL(-) \rightarrow OL(-)/TW(-) \rightarrow OL(-)/TW(-)/GD(-)(Abbreviated as the fourth conditional chain), The impact of their interaction on the

teacher's choice of face-to-face discussion is shown in Figure 2 below.

The first condition chain shows that the probability of face-to-face discussions continues to increase, from 0.931 ± 0.01 to 0.976 ± 0.01 . There is no significant difference between the conditional probabilities, and this change can be considered within the error range, indicating that the probability of teachers choosing face-to-face discussions will not be affected by other condition choices. Similarly, the probability of face-to-face discussions fluctuates in the second, third, and

fourth condition chains, the fluctuation error is within the range of ± 0.028 to ± 0.061 , and the change in conditional probability is also within the error range. It can be considered that not choosing other conditions does not affect the face-to-face discussion.

Comparing the OL (-)/TW (-)/GD (-) in the fourth conditional chain, there was no expected decrease in conditional probability, but a significant increase. The reason for this needs further analysis.

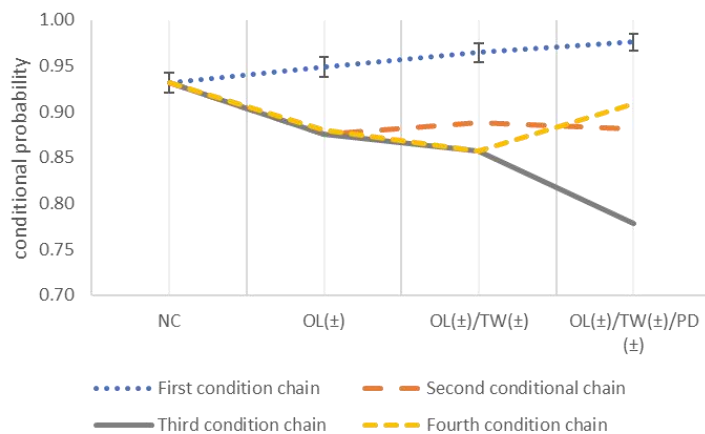


Figure 2. Choose the Frequency of Face-to-face Discussions under Different Conditions

Comparing whether the teacher's choice of the other three peer assistance methods is influenced by other factors can also be analyzed by the conditional probability changes of these three factors. The probability of teachers using "QQ or WeChat" as a form of peer assistance communication is set at two condition chains: NC \rightarrow TW (+) \rightarrow TW

(+)/PD (+) \rightarrow TW (+)/PD (+)/FF (+) and NC \rightarrow TW (-) \rightarrow TW (+)/PD (+) \rightarrow TW (+)/PD (+)/FF (+). Based on whether to choose a learning group as the classification criterion, teachers who choose QQ or WeChat are divided into two categories. The change in conditional probability is shown in Figure 3.

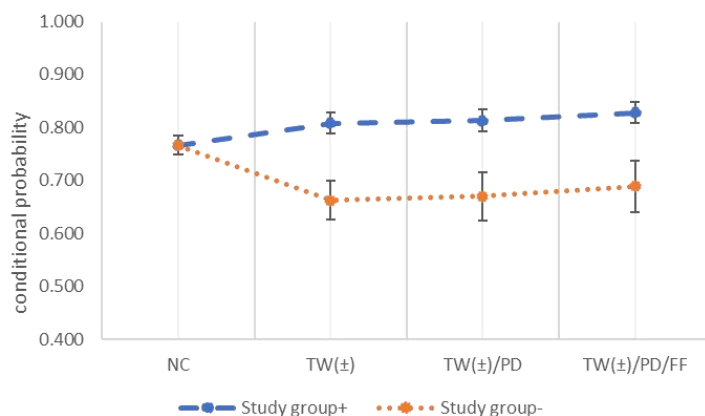


Figure 3. Changes in Conditional Probability of QQ or WeChat

There is a significant difference in the choice of learning group behavior between teachers and those who do not choose learning group behavior. However, between the two types, the introduction of other conditions results in changes in conditional probabilities within the error range, indicating that the relationship between these conditions and the results is independent. It is worth noting that smartphones are currently highly popular in China, but the probability of teachers

identifying QQ or WeChat as peer assistance is only between 0.83 and 0.65, which is lower than face-to-face discussions, indicating that this technology still has limitations and cannot fully meet the communication methods that teachers hope for.

Whether the probability of choosing "topic discussion" as a form of peer mutual communication is influenced by other conditions, we also set NC \rightarrow FF (+) \rightarrow FF (+)/OL (+) \rightarrow FF (+)/OL (+)/TW (+) and NC

→ FF (-) → FF (+)/OL (+) → FF (+)/OL (+)/TW (+) as two condition chains, with whether to choose "face-to-face discussion" as the classification condition. The probability of

teachers choosing topic discussion varies under different conditions as shown in Figure 4.

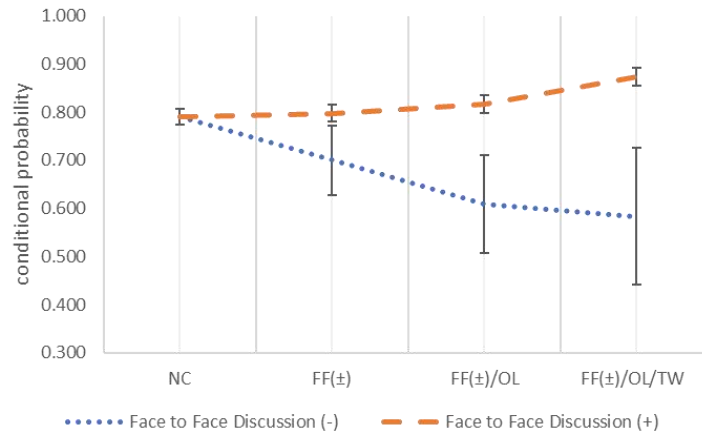


Figure 4. Changes in Conditional Probability of Topic Discussion

There are two types of teachers who recognize "thematic discussions": among the group of teachers who recognize face-to-face discussions, the probability of other forms being recognized as conditions increases, forming a favorable condition chain; while among the group of teachers who do not recognize face-to-face discussions, the probability of other forms being recognized as conditions decreases, forming an unfavorable condition chain. Whether it is recognized that "face-to-face discussion" is an indicator to distinguish teacher types.

conditions, we also set two condition chains: NC → PD (+) → PD (+)/FF (+) → PD (+)/FF (+)/OL (+) and NC → PD (-) → PD (+)/FF (+) → PD (+)/FF (+)/OL (+). The probability of teachers choosing learning groups varies under different conditions, as shown in Figure 5.

Whether the probability of choosing "learning groups" as a form of peer mutual communication is influenced by other

The selection of study groups is greatly influenced by thematic discussions. Teachers who agree with thematic discussions choose study groups 60% more than those who do not agree with thematic discussions. Although choosing other conditions between the two types of teachers will not affect their selection probability (within the error range), the difference between the two types of teachers is significant [7-9].

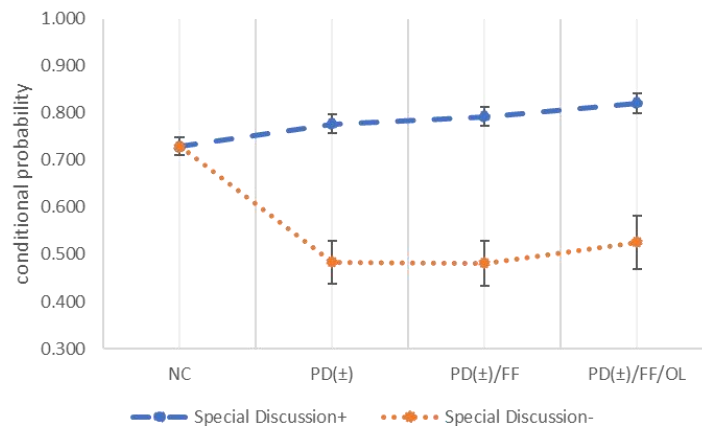


Figure 5. Changes in Conditional Probability of Learning Groups

5. Conclusion

Based on the above research, the following conclusions have been drawn in this article.

from senior experts or teachers in professional fields" do not affect the selection of "teaching or research cooperation projects" for teachers, but "thematic discussions, textbook recommendation meetings or academic

- (1) "Shared online platforms" and "guidance

conferences" and "mentorship, old teachers lead new teachers" have an impact on the selection.

B1ACADAE is also the best condition for teachers to choose "teaching or research cooperation research projects", under which the probability of A occurring is the highest, at 92.6%. Among them, B1 represents "shared network platform" being selected, C represents "guidance from senior experts or teachers in the professional field", D represents "thematic discussions, textbook recommendation meetings or academic conferences", and E represents "pairing of teachers and apprentices, old teachers leading new teachers".

(2) Taking into account the changes in conditional probabilities of the four situations, there exists a cycle of mutual influence.

Face to Face Discussion→Topic Discussion Learning Group→QQ or WeChat→Face to Face Discussion, (→represents strong influence, →represents weak influence), we can put face-to-face discussion, symposium, study group into a group, there is a strong consistency between them, and QQ or WeChat is another form of peer assistance.

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