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Research on the Influence Mechanism Model of University Graduate Education Satisfaction——Based on the Survey Data of Wuhan University of Technology

Fang Han
Wuhan University of Technology
School of Management
Wuhan, Hubei
1149939096@qq.com

Teng Liangwen
Wuhan University of Technology
School of Management
Wuhan, Hubei

***Abstract*—Graduate education satisfaction is an important part of reflecting the quality of graduate education. Based on the survey data of Wuhan University of Technology and structural equation model, this paper established a model of graduate education satisfaction, studies the influences and paths of the guidance relationship, curriculum teaching, academic research, and campus environment on graduate education satisfaction. The research found that: (1) Guidance relationship, academic research, and campus environment have a significant positive impact on graduate education satisfaction. (2) Academic research plays a positive intermediary role in the process in which the relationship between learning guidance affects graduate education satisfaction. (3) The effect of curriculum teaching on graduate education satisfaction is not significant. The results of this research show that the healthy development of graduate education in my country is guaranteed not only by building a strong education and establishing a harmonious relationship between learning and guidance, but also by improving the cultivation of students' scientific research capabilities, and improving the governance of the comprehensive campus environment**

Keywords-Graduate Education Satisfaction; Learning-guidance Relationship; Structural Equation Model; Intermediary Role

I. INTRODUCTION

In July 2020, the National Graduate Education Conference was held to clarify the main task of graduate education in the new era, that is, to further consolidate the foundation of talent for building an innovative country under the new pattern of global talent competition [1]. As an important place for innovation and scientific research in my country, the main mission of key universities should be to improve the quality of graduate education and cultivate high-level talents with innovative consciousness and research capabilities. At present, the quality of postgraduate education in key universities is mainly evaluated by educational administrative departments, academic organizations, industry departments, and social institutions [2]. As an important participant in the process of graduate education, students are not the main evaluation subject of the quality of graduate education. However, they have the most direct experience and the most intuitive feelings about the education they receive. The introduction of postgraduate education satisfaction can effectively make up for the shortcomings of evaluation subjects such as educational administrative departments, academic organizations, industry departments, and social institutions.

II. LITERATURE REVIEW AND RESEARCH HYPOTHESES

Many scholars at home and abroad have researched graduate education satisfaction. Cheng et al. believe that student satisfaction is related to the quality of graduate education [3]. Rienties and Toetenel explored the impact of learning system design on student satisfaction [4]. Lin, Timothy, and others studied the impact of academic experience and school atmosphere on graduate student satisfaction [5]. Zhou Wenhui and others investigated the satisfaction of graduate education in my country from the aspects of course teaching, scientific research training, tutor guidance, and management services [6]. Through continuous investigation and research, Zhou Wenhui and others believe that improving the research capabilities of graduate students and strengthening the construction of the tutor team can increase the satisfaction of graduate education and realize the improvement of the quality of graduate education. Zhang Bei and others constructed a graduate education satisfaction model from four aspects: graduate expectations, course teaching quality, scientific research, and training quality, and management service quality [7]. Based on the above analysis, this article uses the structural equation model, based on the training process of graduate students in key universities, from the perspectives of tutor education, curriculum education, scientific research education, cultural education, etc., to propose research hypotheses affecting graduate education satisfaction.

A. The research hypothesis of the relationship between guidance and graduate education satisfaction.

A guidance relationship is a multi-character and multi-level relationship system formed by tutors and graduate students through teaching and learning to achieve educational and scientific research goals. With the development of higher education in my country, the relationship between learning guidance is no longer a simple relationship between academic guidance and academic exchanges, and gradually has attributes such as emotional connection and personality shaping. Nickola C and others conducted an online questionnaire survey on

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doctoral students at different stages to explore the influence of the academic, personal, and independent support of the tutor on the students' sense of efficacy [8]. Analysis by Chang Haiyang and Du Jing found that tutors can help students cope with graduation pressure, self-satisfaction, and group isolation [9]. Tutors have played a vital role in the career of graduate students. They can help graduate students succeed in many ways. Based on this, the following hypotheses are proposed.

H1: The guidance relationship has a significant positive impact on graduate education satisfaction.

B. The research hypothesis of the relationship between guidance and academic research.

The tutor's academic guidance to graduate students is the core of the guidance relationship. The general manifestations include guiding thesis writing, guiding the research of the subject, guiding the writing of monographs, etc. In the process of guiding graduate students' academic writing, some tutors are dedicated to academic achievements, some tutors are dedicated to the cognitive process, and some tutors are dedicated to communication and exchange. The communication between graduate students and their supervisors in the process of writing a thesis is very important. The support of the supervisor can greatly promote the progress of the thesis and reduce the sense of isolation in the process of graduate thesis writing. Based on this, the following hypotheses are proposed.

H2: The guidance relationship has a significant positive impact on academic research.

C. The research hypothesis of curriculum teaching and graduate education satisfaction.

Curriculum teaching is the foundation of graduate education and a key link to ensure the quality of graduate training. The quality of curriculum teaching is the result of the comprehensive effect of the curriculum system, teaching content, teaching methods and means, teachers' teaching skills, and teaching facilities. According to the research of Yang et al., in the course teaching link, the teaching materials are full of cutting-edge, the teaching content is substantial, the teaching method is flexible, the teacher's comprehensive quality and teaching level are high, the teaching equipment is advanced, and the graduate education satisfaction will be very high [10]. Therefore, the following hypotheses are proposed.

H3: Course teaching has a significant positive impact on graduate education satisfaction.

D. The research hypothesis of academic research and graduate education satisfaction.

Academic research is the core of graduate education and the main indicator reflecting the quality of graduate education. Postgraduates can master basic, standardized, and systematic scientific research methods and improve their scientific research capabilities through subject participation. The survey by Li Chengfeng and others found that the quantity and quality of project participants have a significant positive impact on graduate students' scientific research ability [11]. Besides, academic exchanges can provide postgraduates with a platform for the exchange of ideas and knowledge sharing, and improve the scientific research environment, thereby stimulating postgraduates' interest in academic research, improving their academic standards, and enhancing graduate education satisfaction. Therefore, the following hypotheses are proposed.

H4: Academic research has a significant positive impact on graduate education satisfaction.

E. The research hypothesis of the campus environment and graduate education satisfaction.

The development of graduate students is inseparable from the campus environment where they are located. The school's facilities, safety conditions, and campus culture will affect the thinking and behavior of graduate students [18]. Equipped with reasonable teaching facilities and experimental equipment will often stimulate the interest of graduate students, and a good campus atmosphere will make graduate students more focused. Fang Xi and Wang Kuiming pointed out that improving the learning and living environment on campus can effectively enhance the trust of college students in the school [12]. Based on this, the following hypotheses are proposed.

H5: The campus environment has a significant positive impact on graduate education satisfaction.

Based on Hypothesis H1 and Hypothesis H2, the following hypotheses are proposed:

H6: Academic research plays a part in the mediating role in the role of guidance relationship on graduate education satisfaction.

In summary, the theoretical model of this study is shown in Figure 1.

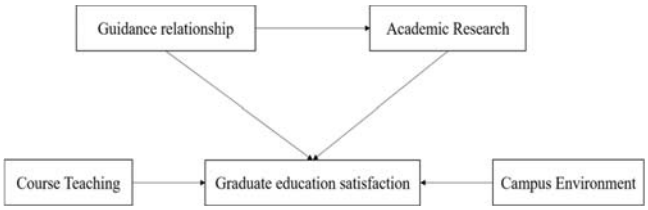

Figure.1 Theoretical model affecting graduate education satisfaction

III. RESEARCH DESIGN

A. Questionnaire preparation

The questionnaire in this article includes two parts: basic information and a measurement questionnaire. The measurement questionnaire involves five research variables, namely, the relationship of guidance, curriculum teaching, academic research, campus environment, and graduate education satisfaction. The measurement items of the initial questionnaire are designed based on existing research. Among them, the measurement items of the guidance relationship are based on the research of Liu Liquan [13] and Zhang Nanxing [14], and are revised and supplemented based on the actual guidance of graduate students. The measurement items for teaching, academic research, and school environment are designed based on the integration of existing literature. And adjusted according to the actual situation. The questionnaire survey was conducted by a combination of forward and reverse questions, and the measurement items were all measured by the Likert 5-point scoring method.

This article revises the initial questionnaire through an online pre-survey. The subjects of the pre-investigation include the heads of postgraduate education and management of various schools of the Wuhan University of Technology, as well as student party members and student leaders. The specific steps are as follows: (1) Make the initial revision of the questionnaire based on the opinions of the leaders responsible for graduate education and management. (2) The first revised questionnaire was sent to the student party members and student leaders of each college through the questionnaire star platform, and a total of 236 valid questionnaires were returned. (3) Perform reliability and validity analysis on the pre-survey data, delete 2 items with lower reliability and validity, and get the final formal questionnaire, with a total of 18 items remaining.

B. Data collection

In this study, an online questionnaire was used to distribute formal questionnaires with the help of the questionnaire star platform, and finally, 900 questionnaires were returned, of which 819 valid questionnaires were valid, and the effective response rate was 91%. This study mainly borrowed software such as Excel2016, SPSS25.0, and AMOS24.0 to organize and analyze the questionnaire data. Among them, Excle2016 mainly used to format and organize the questionnaire data, and SPSS25.0 mainly used the descriptive questionnaire data. Statistical analysis, reliability analysis, exploratory factor analysis, and test of adjustment effects. AMOS24.0 mainly performs confirmatory factor analysis on data, and constructs the initial model and revised model of the structural equation, and conducts a path test and mediation effect test. get a conclusion.

Describe the basic situation of the surveyed subjects in this study, as shown in Table 1.

TABLE I. STATISTICS OF THE BASIC SITUATION OF THE SURVEYED OBJECTS

Basic Information	Category	Number of people	Effective percentage（%）
Gender	Male	543	66.30
	Female	276	33.70
College	College of Science and Technology	540	65.93
	School of Humanities and Social Sciences	279	34.07
education level	Master's degree	724	88.40
	Ph.D. degree	95	11.6
Political status	CPC member	282	34.43
	Communist Youth League	501	61.17
	Democratic parties	1	0.12
	The masses	35	4.27

In terms of gender, there are 543 men, accounting for 66.30% of the total sample, and 276 women, accounting for 33.70% of the total sample, indicating that the distribution of the ratio of men to women in this survey is relatively reasonable. In terms of colleges, the questionnaire is distributed to all colleges of Wuhan University of Technology. This study divides them into two categories: the College of Science and Engineering and the College of Humanities and Social Sciences. The College of Science and Engineering accounts for 65.93% of the total sample; the College of Humanities and Social Sciences has 279 people, accounting for the total sample. Of 34.07%, this ratio is similar to the school's enrollment ratio, indicating that the distribution of subject backgrounds in this survey is more reasonable. In terms of education level, the research object of this study is graduate students, so there are two levels of academic qualifications. Among them, the master's degree is the most, accounting for 88.4%. In terms of political outlook, this study is divided into 4 categories. Among them, there are 282 CCP members, accounting for 34.43% of the total sample; 501 Communist Youth League members, accounting for 61.17% of the total sample; 1 Democratic Party, accounting for the total sample 0.12% of the population; there are 35 people, accounting for 4.27% of the total sample.

IV. RELIABILITY AND VALIDITY ANALYSIS

A. Reliability analysis

Most scholars use Cronbach's Alpha coefficient for the reliability test. Generally, when the coefficient is between 0.7 and 0.8, it indicates stability and reliability. In this study, the Cronbach's Alpha coefficients of five variables, namely, the relationship between study guidance, course teaching, academic research, campus environment, and graduate education satisfaction, are 0.849, 0.949, 0.851, 0.834, 0.899, and the Cronbach's Alpha coefficient of the total table is 0.945, indicating The overall reliability of the questionnaire is relatively high and can be further analyzed.

B. Validity analysis

Exploratory factor analysis. Using the software SPSS25.0, KMO value of the four subscales of guidance relationship, course teaching, academic research, and campus environment were calculated, which were 0.813, 0.830, 0.733, and 0.724 respectively, with the KMO value of the total table was 0.915, higher than 0.8. The significance P-value was less than 0.001, indicating that it is suitable for factor analysis. Principal component analysis and the maximum variance method for factor rotation were used in the study. This study uses principal

component analysis and the maximum variance method for factor rotation. Because the measurement variables in this article are clear, the number of extraction factors is limited to 4, and items that occupy less than 0.5 in any dimension are removed. The results show that the cumulative variance explanation contribution rate of the extracted four common factors reaches 78.373%, which meets the standard of greater than 70%.

V. STRUCTURAL EQUATION MODEL VERIFICATION ANALYSIS

A. Construction and revision of the initial model

(1) Initial model construction. Based on the previous research hypothesis, this article establishes a preliminary structural model, including five latent variables, namely, the relationship of learning guidance, curriculum teaching, academic research, campus environment, and overall satisfaction, corresponding to 18 observed variables. In the model, the study-guidance relationship, curriculum teaching, and campus environment are exogenous variables, academic research and overall satisfaction are endogenous variables, and academic research is an intermediary variable.

(2) Initial model fitting. The selected indicators, fitting criteria, and fitting results of the initial structural equation model are shown in Table 2. The parsimonious index (PNFI, PGFI) has a good fit, the value-added index (IFI, TLI, CFI) has a reasonable fit, and the absolute index has the root mean square error (RMSEA) and goodness of fit index (GFI) all exceed the critical value, but are relatively close, indicating that the initial model needs to be revised.

TABLE II. TABLE OF INITIAL MODEL FITTING COEFFICIENTS

	Statistical test volume	Judgment criteria and critical value	Model results	Goodness of fit
Absolute index	RMSEA	<0.05（well fit） <0.08（reasonable adaptation）	0.119	approaching
	GFI	>0.90（well fit） >0.85（reasonable adaptation）	0.794	approaching
Value-added index	IFI	>0.90（well fit） >0.85（reasonable adaptation）	0.881	reasonable
	TLI	>0.90（well fit） >0.85（reasonable adaptation）	0.857	reasonable
	CFI	>0.90（well fit） >0.85（reasonable adaptation）	0.880	reasonable
Parsimony index	PNFI	>0.50	0.729	good
	PCFI	>0.50	0.737	good

(3) Initial model revision. According to the revised index output by AMOS, this study revised the initial model, mainly establishing correlations among the residual items of the three latent variables of course teaching, campus environment, and graduate education satisfaction. The revised model is shown in Figure 2.

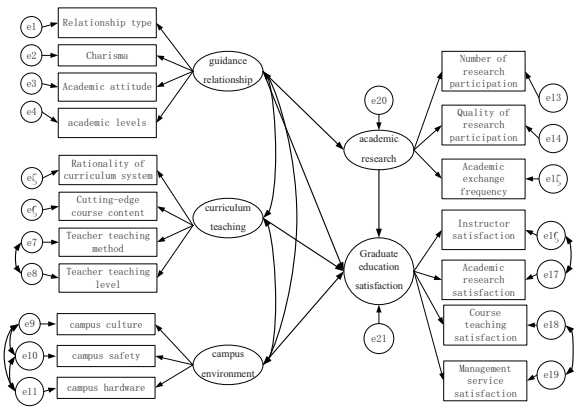

Figure.2 The revised structural equation model

It is verified after a correction that, except for the reasonable adaptation of the RMSEA value, the other indicators are well adapted, indicating that the revised structural equation model has a relatively high overall fitness.

B. Path inspection

The path coefficient of the revised model is shown in Table 3. The path coefficient between the guidance relationship and academic research is 0.620, and the p-value of this path is less than 0.001, indicating that the guidance relationship has a significant positive impact on academic research, so it is assumed H2 is established. The path coefficient between the guidance relationship and graduate education satisfaction is 0.137, and the p-value of this path is less than 0.001, indicating that the guidance relationship has a very significant positive effect on graduate education satisfaction, so assume that H1 is true. The path coefficient between teaching and graduate education satisfaction is 0.026, and the p-value of this path is greater than 0.1, indicating that curriculum teaching has no significant impact on graduate education satisfaction, so hypothesis H3 is not valid. The path coefficient between academic research and graduate education satisfaction is 0.066, and the p-value of this path is less than 0.001, indicating that academic research has a very significant positive impact on graduate education satisfaction, so hypothesis H4 holds. The standardized path coefficient between the campus environment and graduate education satisfaction is 0.810, and the p-value of

the path is less than 0.001, indicating that the campus environment has a very significant positive effect on graduate education satisfaction, so hypothesis H5 holds.

TABLE III. PATH COEFFICIENT TABLE OF THE MODIFIED MODEL

Path relationship			Estimate	S.E.	C.R.	P
Academic research	<---	Guidance relationship	0.620	0.043	14.363	***
Graduate education satisfaction	<---	Guidance relationship	0.137	0.042	3.304	***
Graduate education satisfaction	<---	Curriculum Teaching	0.026	0.047	0.553	0.581
Graduate education satisfaction	<---	Academic research	0.066	0.019	3.535	***
Graduate education satisfaction	<---	Campus Environment	0.810			***

Note: *** means p<0.001

C. *The mediation effect test*

Among the many methods of intermediary effect testing, the Bootstrap method (also known as the self-service method) is highly regarded by scholars because of its high level of detection power. Therefore, this study uses the bootstrap method of sampling 5000 times to conduct the intermediary effect in the model. Detection. The test results of the mediation effect are shown in Table 4. The indirect effect of the easy-knowledge faculty relationship on graduate education satisfaction does not contain 0 in the 95% confidence interval of BC and PC, indicating that the mediation effect is significant; also, the faculty relationship has a significant impact on graduate education. The direct effect of satisfaction does not contain 0 in the 95% confidence interval of BC and PC, and the significance of the path coefficient is less than 0.05, indicating that academic research plays a part of the mediating role in the influence of the guidance relationship on graduate education satisfaction, So assume that H6 holds.

TABLE IV. INTERMEDIARY EFFECT TEST TABLE

Relationship between variables	Unstandardized estimate	Bootstrapping BC upper	BC lower	PC upper	PC lower
The Total Effect of Guidance Relationship on Graduate Education Satisfaction	0.179	0.291	0.078	0.289	0.077
The Direct Effect of Guidance Relationship on Postgraduate Education Satisfaction	0.137	0.255	0.028	0. 4	0.028
The Indirect Effect of Guidance Relationship on Postgraduate Education Satisfaction	0.042	0.074	0.012	0.072	0.011

VI. CONCLUSION AND DISCUSSION

Based on a large amount of theoretical analysis, this study constructed a model of the impact mechanism of graduate education satisfaction, and applied the structural equation model to an in-depth exploration of the relationship between the studied variables, verifying several theoretical hypotheses proposed. Research indicates:

First of all, the tutoring relationship, academic research, and campus environment have a significant positive impact on graduate education satisfaction. That is, the more harmonious the tutoring relationship, the better the academic research results, and the more comfortable the campus environment, the higher the satisfaction of graduate students with school education. Besides, the study-guidance relationship not only directly affects graduate education satisfaction but also has an indirect effect on graduate education satisfaction through academic research. In postgraduate education and teaching, the more harmonious the tutoring relationship, and the easier it is for academic research to achieve results, the higher the satisfaction of postgraduate education. Finally, the effect of curriculum teaching on graduate education satisfaction is not significant. This may be because curriculum teaching does not account for a high proportion of graduate students' study and life, and ordinary schools no longer set up courses after the first grade of graduate students. The specific reasons need further research.

Based on the above conclusions, this research has the following enlightenment: First, establish a harmonious learning relationship with equal emphasis on teaching and emotional connections. Second, strengthen the cultivation of students' scientific research and innovation capabilities, increase student visits and research, short-term exchanges, and academic participation. Third, strengthen the training conditions and capacity building of the school's graduate students, and pay attention to the root and cultivation of university spirit and university culture.

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