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Analysis on the Driving Factors and Realization Path of the Value of Tutor-Student Relationship of Postgraduates-with Medical and Pharmaceutical Universities as an Example

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ABSTRACT

A harmonious relationship between teachers and postgraduates presents the comprehensive value of psychological education, which guarantees training quality and acts as an effective carrier of mental health education of the postgraduates. Based on Bandura's theory of reciprocal determinism and Austin's input-output theory, this paper constructs a model concerning the value of psychological education in the tutor-student relationship. The path of realization is also explored in a structural equation model through a questionnaire survey of 1112 graduate supervisors and administrators in medical colleges. The experimental result indicates that (1) The interaction between teachers and postgraduates promotes the value of psychological education in the highest measure, among which the quality and frequency of tutor-student communication, mutual trust, and respect act as the key influencing indicators. (2) Tutor's professional quality is considered as the fundamental driving force in the realization of psychological education value in the tutor-student relationship, the maximum mediating effect is observed in the developing path of "tutor's professional quality-interaction behavior between teachers and postgraduates-psychological growth of teachers and postgraduates. (3) The objective results obtained by teachers and postgraduates, such as the improvement of quality and quantity, positively promote the overall quality of life satisfaction of both sides, which improves the major psychological growth indicators. (4) In the path that affects the psychological growth of teachers and postgraduates, female groups mainly focusing on natural sciences pay more attention to the tutor-student emotional experience, while male and lower-grade groups pay more attention to behavioral interaction; In the path that affects the interaction between teachers and postgraduates, the tutor does not value the difference in the quality of graduate students, lower-grade and natural science professional groups pay more attention to institutional environment.

KEYWORDS

Postgraduate; tutor-student relationship; the value of psychological education; driving factors

1 Introduction

A harmonious relationship between teachers and postgraduates presents the comprehensive value of psychological education, which guarantees training quality and acts as an effective carrier of mental



health education of the postgraduates. China has paid increasing attention to the value of psychological education in the tutor-student relationship in recent years and promoted the involvement of related personnel. In 2020, the PRC Ministry of Education and the National Development and Reform Commission issued the *Opinions on Accelerating the Reform and Development Postgraduate Education in the New Era*, which explicitly pointed out that “The tutor acts as the person of primary responsibility for the cultivation of postgraduates. It is reasonable to understand the ideological status of them and try to be both academic tutor and life tutor”. However, psychological hurt resulting from teachers does occur, especially for medical postgraduates, who may puzzle over those difficult majors and long-term schooling when compared with other disciplines. They are more likely to be associated with negative emotions and suicidal thoughts [1] or suffer from mental health problems like depression [2]. Meanwhile, the characteristics of high practicalness in medical disciplines give rise to the closer interaction between postgraduates and tutors. Therefore, the relationship between them may critically affect the research interest, training effect, and mental health development of postgraduates.

The value of psychological education presented by communication activities is considered as not merely the unity of knowledge, emotion, idea, and behavior, but an important path to develop psychology shape personality. However, existing studies mainly focusing on the mental health status of postgraduates and the influencing factors of their mental health, emphasize the role of teacher-student relationship quality in promoting students’ mental health [3]. There are little researches on the value of psychological education in the interaction between tutors and postgraduates, it is advocated to alleviate the psychological pressure of graduate students by establishing a good teacher-student relationship. Only a few scholars have analyzed the value composition and realizing strategies of psychological education in the tutor-students relationship from a qualitative perspective [4]. Based on the existing literature, this paper argues that the value of psychological education of tutor-student relationship is carried out by multi-dimensional, systematic tutor-student relationship, rather than unilaterally resulted by education. The educational effect of psychological health is achieved through the complex and dynamic process of teacher-postgraduate interaction, which specifically involves the objective development of tutor-student intelligence and the promotion of their comprehensive quality, the formation of psychological quality, and other implicit “psychological growth”. Therefore, how to characterize the value of comprehensive psychological education of tutor-student relationships? What factors affect the realization of the value of psychological education? Where is the path for realization? For these problems, Empirical research is urgently required to approach an explicit answer. Based on existing researches, this paper studies the value of psychological education in the teacher-student relationship by comprehensively considering Bandura’s reciprocal determinism and Austin’s input-output theory. The conceptual model of the value of psychological education in the tutor-student relationship is firstly proposed in related fields. 1112 sample data are obtained through a sampling survey in medical colleges and universities, and the structural equation model is constructed to verify it. It reveals the constituent elements and realization path of the value of psychological education in the tutor-student relationship and enriches the theoretical and empirical research of psychological education for postgraduates.

2 Construction of Hypotheses and Models

2.1 Construction of Models

The ultimate value of mental health education lies in the formation of the value-oriented subject, which is mainly manifested in the development of the potential of teachers and postgraduates so that they are both trained to be talents with perseverance, creativity, and mental strength. At present, there is no literature about the construction of the psychological education value model of the tutor-student relationship, while the two representative theories discussing the essence of the education process, namely Bandura’s and Austin’s theory, lay a certain foundation for this research.

On the path to achieving cooperation and spiritual acceptance, the relationship between tutors and postgraduates is considered the carrier of mental health education to realize the certain value of psychological education, including creating certain quality and quantity of scientific output and realizing “intelligent development” in an objective manner. It may also improve the comprehensive quality and innovative potential of them, thus promote the formation of harmonious psychological quality and realize the ultimate “psychological growth”. Two factors, namely “intelligence development-objective result” and “psychological growth-subjective result” are hereby introduced in this paper as a presentation of results in this study to explore the driving relationship between tutor-student interaction behavior and the value of psychological education.

The psychological interaction between teachers and postgraduates is embodied in cognition, emotion, and volitional behavior, etc. According to Bandura’s reciprocal determinism theory, the learning process of any organism is caused by the interaction among the individual, environment, and behavior [5]. Lewin’s psychological field theory: $B = f(P \cdot E)$ also agreed that human behavior is a function of the personal state (P) and environment (E). An individual may shape the environment by cognition, character, and values, and the environment may also gradually change the internal of the individual, and the interaction between them also affects the behavior. Therefore, the cognitive, personality and other individual qualities of both sides constitute the basis of scientific research, learning, interaction, and cooperation in the co-constructed and co-shared relationship between teachers and postgraduates.

The terms “tutor quality” and “postgraduate quality” are introduced in this paper, the important social environment factors, including postgraduate scientific research and training system, tutor selection, and supervision system, are also introduced as “institutional environment” in this paper. The psychological activities between tutors and postgraduates are presented by the “tutor-student interaction behavior” of communication in scientific research and learning tasks and the “tutor-student emotional experience” of equality and respect in daily communication. Therefore, to comprehensively grasp the driving effect of individual, environment, and behavior on the value of psychological education in the tutor-student relationship, five factors are included in this research: tutor quality (individual), postgraduate quality (individual), institutional environment (environment), tutor-student interaction behavior (behavior) and teacher-postgraduate emotional experience (behavior).

From the perspective of the whole process of mental health education for postgraduates, the author further explores the logical relationship between the driving factors and the result factors in this paper. Austin, an American educator, had given a famed theory of input-output to describe the cultivation of postgraduates and constructed the IEO model. The “input-environment-output” model points out that the “input” (characteristics and experiences of students) and “environment” (academic atmosphere and social interaction of universities) of higher education interact to produce the final “output” [6]. Differ from Austin’s focus on exogenous variables like “environment”, Chinese scholar Yukun Chen spares more efforts on the process of talent cultivation and puts forward the guarantee model of “input-process-output” [7]. Based on the above-mentioned theories, this study investigates the impacts of the tutor-student relationship on the whole process of postgraduates’ mental health education, which serves as an important “input-output” process in higher education. Driven by the input factors like self-cognition and system, postgraduates and their tutors constitute a relationship and achieve the output goals of intelligent and psychological development of both sides through social and spiritual interaction. Therefore, this study integrates the above-mentioned seven factors into the model of the value of psychological education in the tutor-student relationship. Three driving forces of tutor quality, postgraduate quality, and institutional environment are introduced as input variables, while the tutor-student interaction behavior and emotional experience are taken as process variables, and the intelligent development and psychological growth of both sides are taken as outcome variables. Furthermore, a conceptual model of “value of psychological education in the tutor-student relationship” is constructed to present the comprehensive psychological education value of “knowledge, emotion, idea and behavior”, as illustrated in Fig. 1.

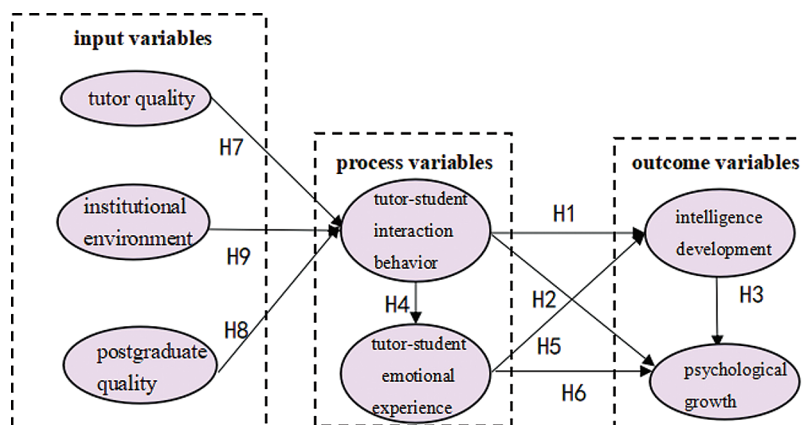


Figure 1: Conceptual model of psychological education value in tutor-student relationship

According to the analysis of the variable composition and logical relationship of postgraduates' psychological education value, the meaning of five driving variables and two result variables are hereby summarized as shown in Table 1. The value of psychological education in tutor-student relationships originates from the relationship between teachers and postgraduates based on mutual recognition and collective scientific research demands, which is subject to the objective factors including postgraduates' scientific research teaching system and the individual quality of both sides. This model realizes the spiritual interaction through the communication between teachers and postgraduates, equal respect and other behavior and emotional interaction process, to promote the intelligent development and psychological growth of both sides, which further improve the mental health of them, and meet the social demand for talents with fine psychological quality.

Table 1: The meaning and logical classification of variables in the model

Variable	Meaning	Logical classification
Tutor quality	The cognition, personality, and other individual qualities of teachers when constituting relationships	Input variable
Postgraduates quality	The cognition, personality, and other individual qualities of postgraduates when constituting relationships	
Institutional environment	The social environment under the system of postgraduate cultivation, tutor evaluation, and supervision	
Tutor-student Interactive behavior	Mutual communication and exchange in the practice and psychological interaction of scientific research projects	Process variables
Tutor-student Emotional experience	Daily communication, equality, respect, and other emotional interaction processes	
Tutor-student Intellectual development	Objective intelligence development indicators like quality and quantity of scientific research cooperation achievements	Outcome variables
Tutor-student Psychological growth	The development of teachers' and postgraduates' comprehensive quality, psychological quality, and other implicit "psychological growth" indicators	

2.2 Construction of Hypotheses

2.2.1 The Relationship between the Tutor-Student Interaction and the Value of Psychological Education

In social relations, the behavior of individuals may naturally produce corresponding results. It is hereby deduced that the emotional experience of an individual is generally expressed by the external behavior as the carrier. The significant interaction between behavior and emotion serves as an explicit factor of the “tutor-student” relationship”. Therefore, this paper focuses on the impacts of two driving factors, namely “tutor-student interactive behavior” and “tutor-student emotional experience” on the outcome factors.

(1) Tutor-student interactive behavior, intellectual development, and psychological growth

Most researchers tend to measure tutor’s guidance through the investigation of achievement indicators such as academic output. Smith et al. [8] research reveals that there is a positive correlation between the positive tutor-student relationship formed through value intervention and the academic progress of postgraduates. Meanwhile, Mizany et al. [9] proposed that a harmonious tutor-student relationship positively affects academic ability such as thesis writing and stimulating scholarly productivity [10], which serves as an influencing factor of postgraduates’ all-round development of interpersonal communication and mental health [11]. The interaction and cooperation between teachers and postgraduates require both sides to participate, exchange information, and share opinions to realize the common growth of both sides concerning professional and value, that is, to achieve the ultimate psychological growth.

Meanwhile, the evaluation of tutor-student relationships to promote psychological growth is considered the subjective emotion and cognition of the relationship. Zhou et al. [12] pointed out that the objective performance may positively affect subjective indicators such as satisfaction, which indicates that the subjective cognition of an individual is generally based on objective facts. The objective indicator “tutor-student intelligence development”, which serves as the output of efficient scientific research cooperation between teachers and postgraduates may affect the subjective evaluation of postgraduates’ psychological growth, including life satisfaction, the cohesion of teachers, and postgraduates, and the formation of fine psychological quality of them. The following hypothesis is hereby proposed (see Fig. 1 for the label of hypothesis, similarly hereinafter).

H1: The interaction between teachers and postgraduates positively affects the development of their intelligence.

H2: The interaction between teachers and postgraduates positively affects the psychological growth of them.

H3: The development of their intelligence positively affects the psychological growth of teachers and postgraduates.

(2) Emotional experience, intelligence development, and psychological growth of teachers and postgraduates

The relationship between tutors and postgraduates is not merely considered a monotonous academic guidance and exchange of knowledge relationship, but a relationship retaining passion and inspiration, mutual respect and trust by the caring personal relationship between them [13]. Xu et al. [14] proposed that although favoritism promotes interactive behavior, emotion is generally produced in the process of interaction, that is, emotion serves as the product of interactive behavior.

The relationship between teachers and postgraduates affects the development of the latter’s intelligence through its effect on their behavioral adaptability and emotional state [15], and then realizes the improvement and growth of teachers and postgraduates’ comprehensive psychological quality. The positive emotional attitude of tutors will have a positive impact on the teaching and research activities of both teachers and

students. The effect of emotional change on creativity is varied and the positive reversal of emotion positively affects individual creativity [16], then the corresponding negative emotion reversal poses negative impacts on individual creativity [17]. Liu et al. [18] propose that positive emotion has a positive moderating effect on users' satisfaction. To sum up, the following assumptions are given in this paper:

H4: The tutor-student interactive behavior positively affects the emotional experience of teachers and postgraduates.

H5: The emotional experience of teachers and postgraduates positively affects the development of their intelligence.

H6: The emotional experience of teachers and postgraduates positively affects their psychological growth.

2.2.2 The Relationship between Tutors, Postgraduates, Institutional Factors, and Tutor-Student Interactive Behavior

Fundamentally, the mutual relationship between postgraduates and teachers is a symbiotic one, teachers and postgraduates are psychologically compatible with each other and overcome the obstacles together [19], to build a harmonious teacher-student relationship [20]. The tutor acts as the main body of postgraduate education [21], their positive attributes should involve reliability, confidence, and encouragement, etc. Moskvicheva's [22] research at the National University of technology in St. Petersburg reveals that the academic pursuit and personality of tutors will affect the interaction between tutors and postgraduates, thus affecting the relationship between them. From the perspective of postgraduates, their individual factors, including historical and personal characteristics significantly affect the expression between teachers and postgraduates and their relationship [23]. Learning motivation, self-efficacy, and other personal factors can also affect postgraduates' learning satisfaction [24]. Based on the survey data, Kevin et al. [25] applied regression and other methods to process the data, which reveals that postgraduates' family background, race, and personality may affect the relationship.

Meanwhile, the relationship between postgraduates and teachers is subject to institutional factors. Chen [26] pointed out that the lack of system guarantee and the invalid supervision of anomie behavior result in the contradiction between the postgraduates and teachers, and the supervision of important matters related to the vital interests of postgraduates should be strengthened. Welsh et al. [27] also mentioned that the implementation of a joint supervision system and multiple supervision system may improve the personal supervision of tutors. To sum up, the following assumptions are hereby proposed:

H7: Tutors' quality positively affects the tutor-student interactive behavior

H8: Postgraduates' quality positively affects the tutor-student interactive behavior

H9: Institutional environment positively affects the tutor-student interactive behavior

3 Scale Development and Data Collection

3.1 Scale Development

The questionnaire survey is applied in this paper to collect data and verify the proposed conceptual model. Considering that there are rare empirical researches on the value of psychological education in the tutor-student relationship, its structure and measurement method have not been clearly illustrated as well, a self-made scale is introduced based on the grounded theory and using of NVivo software, which analyzes and codes the data of literature previously collected and the interview text and then forms the main body of the questionnaire, as shown in Table 2. The specific questionnaire consists of five parts: the first part surveys the basic information of questioned people; the second part judges the value identity of psychological education of social relations between teachers and postgraduates; the third part acts as a process scale of the value of psychological education of tutor-student relations, including the quality of

tutors, the quality of postgraduates, the system environment, the interactive behavior of tutors and their emotional experiences. There are 50 indicators involved in the five driving factors. Then the fourth part, namely the resulting scale, reflects the value of psychological education in the tutor-student relationship, including eight indicators in the result factors of tutor-student intellectual development and psychological growth. The fifth part aims to collect tips on improving the mental health of postgraduates through the teachers-postgraduate relationship. Except for the basic personal information and open issues, the other items are designed according to the Likert five-level scale.

Table 2: Measurement indicators of the value of Tutor-student relationship of postgraduates

Variable	The measurement indicators	Number of indicators
Tutor quality	moral character, Responsibility, guidance style, the scientific research level, academic attitude, guidance level, management ability, Adopted assistance guidance model, Values, Leadership qualities, Professional pressure, Number of students brought, Scope of student training rights, Number of topics and funding	14
Institutional environment	Tutor-student mutual selection system, Tutor selection system, Tutor replacement system, Tutor evaluation system, Tutor supervision system, Tutor's student training power scope, Graduate scholarship incentive system, Research and learning conditions, Faculty management system, Team atmosphere, Subject attributes Learning ability, scientific research ability, learning attitude, career planning, pressure-bearing ability, scientific research pressure, training level or grade, number of projects involved, age difference with tutors, personality differences, role positioning cognitive differences, scientific research cognitive differences	11
Postgraduate quality	Learning ability, Scientific research ability, Learning attitude, Career planning, Pressure-bearing ability, Scientific research pressure, Training level or grade, Number of projects involved, Age difference with tutors, Personality differences, Role positioning cognitive differences, Scientific research cognitive differences	12
Tutor-student Interactive behavior	the frequency of communication, the quality of communication, The initiative of graduate students, The initiative of tutors, Whether tutors can teach in accordance with their aptitude, The motivation of tutors to graduate students	6
Tutor-student Emotional experience	The sense of equality, The sense of respect , The sense of trust, The sense of happiness, The sense of satisfaction, A sense of internal fairness due to comparisons among members of the division, A sense of external fairness due to comparisons between different divisions	7
Tutor-student Intellectual development	Improve the efficiency of scientific research tasks, Increase in the number of scientific research results, Improve the quality of scientific research results	3
Tutor-student Psychological growth	Improve the comprehensive quality of tutors and students, Tutor and student innovation potential development, Improved tutor and student life satisfaction, Increased team cohesion between tutors and students, Good psychological quality and quality formation of tutors and students	5

3.2 Data Collection

The pre-survey was firstly carried out according to the initial questionnaire, and then the authors went through project analysis of the pre-survey data, exploratory factor analysis and combined them with the feedback of the pre-survey object, the final questionnaire was hereby formed by deleting some items and semantic modification. The data collection of the formal survey was conducted from July to November 2019, mainly from 9 regions including Jiangsu, Shanxi, Shanghai, Shandong, Guangdong, etc., and targeted the main participants in the relationship between tutor-student in medical/pharmaceutical colleges and universities, including postgraduates and tutor, taking into account a few postgraduate training unit managers. A total of 1,117 questionnaires were collected in the formal survey, including 1,112 valid questionnaires, with an effective recovery rate of 99.55%. AMOS22.0 was used to fit and test the model by data analysis of the sample.

The 1,112 samples include comprehensive groups and reflect the general situation of medical colleges. This is specifically explained as follows: (1) The survey is featured with reasonable groups, age, and guidance years concerning participates. 171 supervisors (15.38%), 835 postgraduates (75.09%), more than 62 doctoral students (5.58%), and 44 university administrators (3.97%) participated in this survey. The ratio of tutors to postgraduates is about 1:5, which is similar to the statistics of 1:6.2 in the 2018 National Education Statistical Yearbook (440000 tutors and 2731300 postgraduates). In terms of age, people aged 21–26 accounts for (821%, 73.83%) the most; The number of tutors with varied guidance years is relatively balanced, with the proportion of 0–3 years, 3–5 years, 6–10 years and more than 10 years being 3.42%, 2.70%, 3.51%, and 5.76%, respectively. The details are shown in Table 3. (2) In the survey sample, the proportion of female postgraduates (716%, 64.39%) is higher than that of male postgraduates (396%, 35.61%), the gender ratio approaches 2:1, and the difference in subject distribution can be more significant, the proportion of natural science postgraduates (919%, 82.6%) and humanities postgraduates (193%, 17.4%) is approaching 5:1. The results reflect the general situation that medical universities are dominated by natural science disciplines, and the number of female postgraduates is more than that of males.

Table 3: Basic Information of the Samples

Sample characteristics		Number	Percentage (%)	Sample characteristics		Number	Percentage (%)
Identity	Tutors	171	15.38	Gender	Male	396	35.61
	Doctors	546	49.10		Female	716	64.39
	Master	351	31.56	Age	21–26	821	73.83
	Administrator	44	3.96		27–30	74	6.65
Guidance period	0~3	38	3.42		31–40	97	8.72
	3~5	30	2.70	40–55	106	9.53	
	6~10	39	3.51	Discipline	Natural science	919	82.60
	10 plus	64	5.76		Humanities	193	17.40

4 Empirical Test and Result Analysis

4.1 Confirmatory Factor Analysis and Examination of Its Reliability and Validity

Before the analysis of the structural equation model, confirmatory factor analysis was carried out on the conceptual model, which includes the driving variables and outcome variables such as tutors' quality,

postgraduates' quality, tutor-student interaction behavior, etc. to further analyze the reliability of the subordinate relationship between the variables in the questionnaire and the measurement indicators. Meanwhile, a series of goodness of fit statistics, factor load, standard error, and other indicators of parameters are observed when evaluating the goodness-of-fit of the measurement model and data.

According to the results of confirmatory factor analysis, the redundant items in the scale are deleted. The factor load value of each driving variable and outcome variable is measured in the range of 0.50 to 0.95, indicating a fine fitness of the model. The larger factor load value better reflects the characteristics of the driving variable to be measured [28]. Therefore, the index with factor load less than 0.5 under each potential driving variable and result variable is deleted. In addition, items with independent measurement errors are also deleted when encountering the large parameter correction index value [29]. The load of the reserved indexes on the corresponding factors can be higher than 0.5, the final questionnaire index system is shown in Table 4. From the results, the psychological education value of tutor-student relationship of postgraduates is a multi-dimensional construction, which is mainly composed of two scales: the process scale and the outcome scale, including 7 variables composed of 5 driving factors and 2 outcome factors, and corresponding 26 measurement indicators. The fitting index of the model result is finally measured as NC value (χ^2 ratio of free degree) = 3.578, GFI = 0.933, RMSEA = 0.048; NFI = 0.933, IFI = 0.951, TLI = 0.942, CFI = 0.951, which shows a better fitting effect in the confirmatory factor analysis for the model.

Table 4: The value of the relationship between graduate students and tutors

Variable		The measurement indicators	Number of indicators
Process scale	Tutor quality	Moral character (A1), The scientific research level (A4), Academic attitude (A5), Guidance level (A6), Management ability (A7)	5
	Institutional environment	Tutor selection system (B2), Tutor Evaluation System (B4), Tutor supervision system (B5)	3
	Postgraduate quality	Learning ability (C1), Research ability (C2), learning attitude (C3), Pressure endurance (C4)	4
	Tutor-student Interactive behavior	The frequency of communication (E1), the quality of communication (E2), Initiative of postgraduate students (E3),	3
	Tutor-student Emotional experience	The sense of equality (D1), the sense of respect (D2), the sense of trust (D3), the sense of satisfaction (D5)	4
Outcome Scale	Tutor-student Intellectual Development	Improve the efficiency of scientific research tasks (X1), Increase in the number of scientific research results(X2), Improve the quality of scientific research results (X3)	3
	Tutor-student Psychological growth	Tutor and student innovation potential development (X5), Improved tutor and student life satisfaction (X6), Increased team cohesion between tutors and students (X7), Good psychological quality and quality formation of tutors and students (X8)	4

The reliability and validity of the scale are then tested after confirmatory factor analysis. Cronbach α Coefficient and component reliability (CR) are used to evaluate the reliability of the scale, the Cronbach α of each driving variable and outcome variable is measured over 0.8, higher than the

acceptable level of 0.7 [30]. The CR values of driving variables and outcome variables are measured between 0.817 and 0.859, indicating fine reliability in the measurement model.

Validity refers to the degree to which the measurement index reflects each factor. This paper tests the validity of driving variables and outcome variables by convergence validity and discriminant validity. The variance extracted (AVE) is adopted in this paper to characterize the convergence validity, whose results show that the AVE value of each variable is between 0.578 and 0.623, except for the variable of tutors' quality measured as 0.494, close to 0.5 [30] indicating an acceptable result. The results of reliability and convergence validity after data validation are illustrated in Table 5.

Table 5: Test results of model reliability and convergence validity

Variable	Reliability		Convergent validity
	CR	Cronbach α value	AVE
Tutor quality	0.828	0.823	0.494
Institutional environment	0.829	0.818	0.623
Postgraduate quality	0.841	0.835	0.578
Tutor-student Interactive behavior	0.823	0.819	0.609
Tutor-student Emotional experience	0.853	0.846	0.595
Tutor-student Intellectual development	0.817	0.807	0.601
Tutor-student Psychological growth	0.859	0.858	0.604

Discriminant validity measures the differences among variables, which can be tested by comparing “the square root of the factor’s variance extract (AVE)” with “the correlation coefficient between this factor and other factors”. When the current factor is greater than the latter, it indicates that each factor scale presents fine discriminant validity [30]. The results reveal that the square root of AVE of each variable is greater than the correlation coefficient between this factor and other factors, thus each model for factor measurement shows fine discriminant validity, as illustrated in Table 6.

Table 6: Test results of discriminant validity of the model

	Tutor-student Emotional experience	Tutor-student Psychological growth	Tutor-student Intellectual development	Tutor-student Interactive behavior	Institutional Environment	Tutor quality	Postgraduate quality
Tutor-student Emotional experience	0.771						
Tutor-student Psychological Growth	0.564	0.777					
Tutor-student Intellectual development	0.434	0.634	0.775				

(Continued)

Table 6 (continued).

	Tutor-student Emotional experience	Tutor-student Psychological growth	Tutor-student Intellectual development	Tutor-student Interactive behavior	Institutional Environment	Tutor quality	Postgraduate quality
Tutor-student Interactive behavior	0.716	0.539	0.500	0.780			
Institutional Environment	0.385	0.249	0.218	0.339	0.789		
Tutor quality	0.575	0.481	0.468	0.659	0.345	0.703	
Postgraduate quality	0.436	0.302	0.354	0.579	0.264	0.615	0.760

4.2 Homologous Deviation Test

Considering that the data obtained are all filled in by the respondents in the same questionnaire, it is necessary to consider the impacts of common method variance. In terms of program control, the method involving investigator concealment and reverse item design is adopted in this paper. The reverse items in the scale are described as “the city where the school is located” and “the place where the graduate students come from”. Meanwhile, it also balances the language expression and order effect of items. Concerning statistical control, the survey data were tested by Harman single factor test [31]. Factor analysis was implemented for all the indicators of the process scale and the outcome scale, whose results show that the first factor accounts for 33.81% of the total, less than 40%. Therefore, it is considered that the data homology deviation test results of this study fall in the acceptable range.

4.3 Model Fitting and Data Testing

4.3.1 Outcomes of Model Fitting

The structural equation model is adopted in this part to investigate the path relationship among the variables in the value model of psychological education in the tutor-student relationship. Firstly, based on the conceptual model and the index system determined after the reliability and validity test of the questionnaire survey, the software of AMOS22.0 is used to construct and test the fitting degree of the model. The commonly applied reference standard [28] and test results are shown in Table 7. The fitting index of the model is NC value = 3.719, GFI = 0.928, RMSEA = 0.049; NFI = 0.928, IFI = 0.946, TLI = 0.939, CFI = 0.946. When NC value > 5, the model requires to be modified. Although the model does not meet the simple adaptation degree of <3, it still falls in the acceptable range, and there is no need to modify the model [28]. Generally speaking, the structural equation model fits well with the data in this paper.

Table 7: Fit index of the model

Fit index	Absolute index			Relative index			
	NC value (χ^2 ratio of free degree)	GFI	RMSEA	NFI	IFI	TLI	CFI
Standard	<3	>0.90	<0.08	>0.90	>0.90	>0.90	>0.90
Test results	3.719	0.928	0.049	0.928	0.946	0.939	0.946
Adaptation judgment	No	Yes	Yes	Yes	Yes	Yes	Yes

4.3.2 Results of Hypothesis Test

By conducting statistical analysis of the model, the standardized path coefficient and significance results are obtained, as shown in Table 8. It can be seen that the significant level of hypotheses H1, H4, and H6 all reach 0.01, and H2 is also significant at the level of $p < 0.05$, indicating that the process variables of tutor-student interactive behavior and emotional experience positively affect the outcome variables, and the emotional experience has an indirect influence on the psychological growth as well. Meanwhile, this study reveals that the hypothesis H3 has passed the data test, that is, the intellectual development of teachers and postgraduates has a significant positive impact on the psychological growth of them. The path of three input variables including tutor quality, postgraduate quality, and institutional environment to the process variable of tutor-student interaction behavior reached a significant level of 0.001. Hypothesis H7, H8, and H9 are hereby verified. However, hypothesis H5 does not reach the significant level of 0.05, indicating that the emotional experience of them merely affects the psychological growth of teachers and postgraduates, while it does not positively affect the intellectual development of teachers and postgraduates.

Table 8: Path coefficient and significance of the model

Hypothesis	Path relation	Standardized path coefficient	S.E.	C.R.	P	Support or not
H1	Tutor-student Intellectual development ← Tutor-student Interactive behavior	0.489	0.06	8.134	***	Yes
H2	Tutor-student Psychological growth ← Tutor-student Interactive Behavior	0.109	0.051	2.15	*	Yes
H3	Tutor-student Psychological growth ← Tutor-student Intellectual development	0.424	0.036	11.885	***	Yes
H4	Tutor-student Emotional experience ← Tutor-student Interactive behavior	0.658	0.037	17.833	***	Yes
H5	Tutor-student Intellectual development ← Tutor-student Emotional experience	0.109	0.065	1.692	0.091	No
H6	Tutor-student Psychological growth ← Tutor-student Emotional experience	0.32	0.054	5.933	***	Yes
H7	Tutor-student Interactive behavior ← Tutor quality	0.639	0.06	10.666	***	Yes
H8	Tutor-student Interactive behavior ← Postgraduate Quality	0.334	0.052	6.425	***	Yes
H9	Tutor-student Interactive behavior ← Institutional Environment	0.12	0.026	4.596	***	Yes

Note: *** indicates a significant correlation at 0.001 level (bilateral), * indicates a significant correlation at 0.05 level (bilateral).

4.3.3 Impact Effect Analysis of Variables

The test results of empirical data of each variable in the structural equation model are illustrated in Fig. 2, which further explores the relationship and impacts among variables, following information is hereby given:

1. The variables analysis of total effect illustrates that the process variables pose a greater impact on the outcome variables, and the largest total effect is detected in the variable of tutor-student interactive behavior. The largest total effect is detected in tutor-student interactive behavior among all the dimension of variables, whose direct positive effect is measured 0.11, and the indirect effect conducted through the emotional experience is $0.74 * 0.29 = 0.21$, and the indirect effect through the intelligent development of teachers and students is $0.46 * 0.45 = 0.21$, the total effect is finally measured 0.53. The variable with the second-largest influencing effect is the intellectual development of teachers and postgraduates, which is measured at 0.45, indicating that the subjective evaluation between the two outcome variables is generally based on certain objective facts. Further analysis reveals the greatest impact of interactive behavior between teachers and postgraduates on the development of intelligence, which is measured at 0.46.

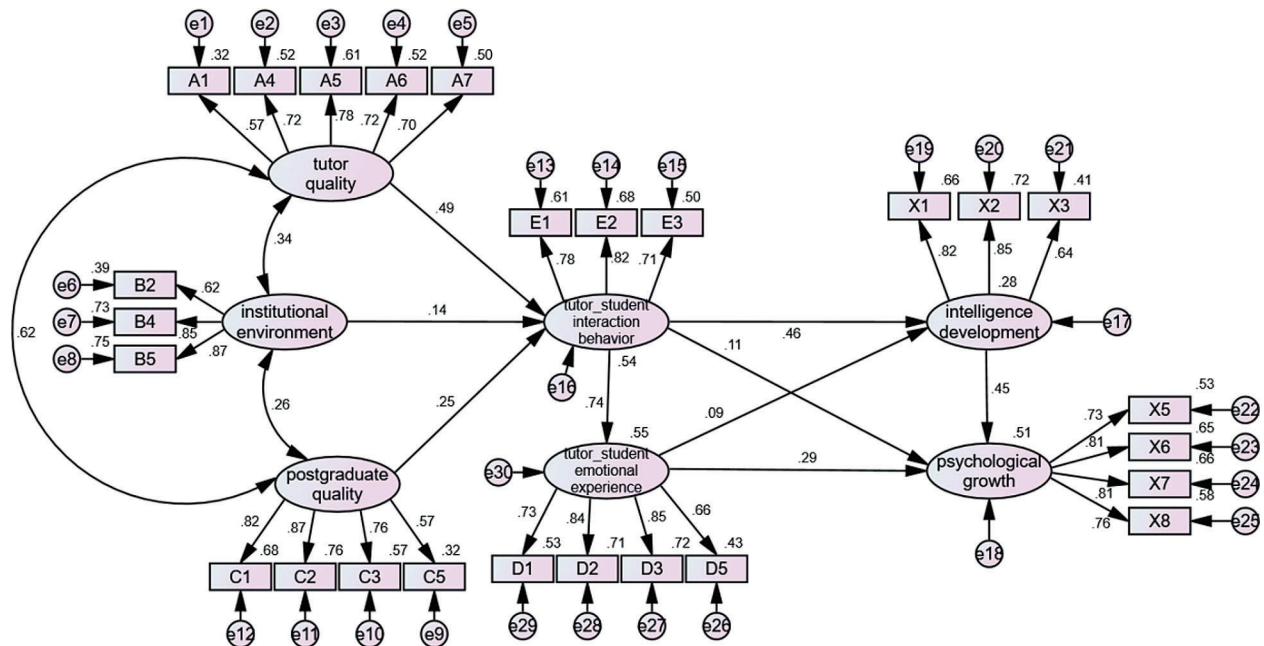


Figure 2: Data validation results of variables in structural equation model

The institutional environment acts as the least influential variable to the psychological growth of teachers and postgraduates. The influence of tutor quality, postgraduate quality, and institutional environment on the psychological growth is generally weak, whose effect degree is respectively measured as 0.26, 0.13, and 0.07. It can be seen that the input variables pose a weak driving effect on the result variables when compared with the process variables.

Therefore, further exploration of the measurement indicators of process variables indicates that the quality and frequency of tutor-student communication pose the greatest impact on their interaction. Among the four measurement indicators of tutor-student interactive behavior, the quality of communication (E2) shows the largest influence coefficient (0.82), followed by the frequency of communication (E1), with a coefficient of 0.78, indicating that the quality and frequency of communication play a key role in the psychological

education of tutor-student relationship. The results are consistent with the current situation of practical characteristics of medical specialty. Chinese medical postgraduates pay more attention to the practice and training of clinical experience. Similarly, pharmaceutical postgraduates are more engaged in the exploration and study of scientific research projects in the laboratory. The safety risk of such practice and experimental operation requires tutors to follow the daily scientific research and mental health of postgraduates and keep close communication with them.

Sense of trust and respect are considered the most influential indicators of the variables of teachers-postgraduate emotional experience. Among the four measurement indexes, the largest influence coefficient is detected in the sense of trust (D3), which is 0.86. The influence coefficient of respect (D2) is similar to that of trust, reaching 0.84. The establishment of trust mechanism serves as the guarantee of improving the performance of the innovation team in university [32]. The results of this study further confirm the significance of trust and respect in the psychological education of tutor-student relationships.

2. Input variables pose a significant direct impact on the interactive behavior between teachers and postgraduates. Each input variable is mediated by process variables involving tutor-student interactive behavior, which serves as the fundamental driving variable of the value of psychological education in the tutor-student relationship. Specifically, the direct driving effect of tutor quality, postgraduate quality, and institutional environment on teacher-postgraduate interaction behavior can be greater, in which the tutoring quality presents the largest impact, with the effective coefficient of 0.49, followed by postgraduate quality of 0.25, and then the institutional environment of 0.14. To deeply analyze the specific influence path of input variables on the psychological growth of teachers and postgraduates, and explore the mediating effect value of each path, the indirect effects of each path are calculated and compared, which indicates that the mediating effect of tutor quality \rightarrow tutor-student interactive behavior \rightarrow tutor-student psychological growth presents the largest value, which is $0.49 * 0.74 * 0.29 = 0.11$. In other words, the tutor's quality finally affects the psychological growth of teachers and postgraduates through interactive behavior, which verifies the importance of the latter. However, the other paths are calculated less than 0.1, the calculation process is not presented considering its weak impacts.

Further analysis of the input variable with the largest impact, namely the tutor quality, illustrates that the impact of academic attitude (A5) is featured with the largest impact coefficient of 0.78, followed by the scientific research level (A4) and guidance level (A6) of tutors, both of which are 0.70, teachers' consciousness and scientific research level also play an important role.

4.3.4 Multi-Group Analysis Based on Demographic Characteristics

In order to test whether the model can be applied to different groups with the same characteristics, we use 4 demographic variables, including identity, gender, discipline, and grade as the moderator to conduct a multi-group analysis of the model (since the identity reflects age to a certain extent, the age is not checked again here), the results are shown in Table 9. It can be seen that the results of the grouped samples are basically the same as the results of the total sample. If the path of hypothesis testing is not passed in the previous article, such as the path of tutor-student emotional experience that positively affects the development of tutor-student intellectual is also not significant in all the grouped samples, however, there are still some differences in the significance and impact of different groups, specifically as follows:

In the path that tutor-student interactive behavior positively affects the psychological growth of tutor-student, only the male and lower-grade groups are significant at the 0.05 level, while the rest of the groups are not significant. Among the three paths in which tutor-student interactive behavior affects the psychological growth of teachers and students, the test results of all samples show that the direct path of tutor-student interactive behavior \rightarrow tutor-student psychological growth is the least influential (only 0.11),

see Fig. 2. To a certain extent, it shows that mainly male and lower-grade groups pay more attention to the direct influence of interactive behaviors on psychological growth.

Table 9: Estimation results of multi-group structural equation model based on demographic variables

Path relation	Tutors		Students		Male		Female	
	Estimate	<i>t</i> -value	Estimate	<i>t</i> -value	Estimate	<i>t</i> -value	Estimate	<i>t</i> -value
TID← TIB	0.448**	3.094	0.472***	7.087	0.3**	2.964	0.547***	7.955
TPG←TIB	0.16	1.298	0.115	1.918	0.22*	2.292	0.047	0.773
TPG←TID	0.358***	3.689	0.458***	10.816	0.338***	5.551	0.545***	11.073
TEE←TIB	0.657***	5.04	0.772***	17.079	0.771***	10.942	0.727***	14.048
TID← TEE	-0.045	-0.345	0.101	1.569	0.158	1.591	0.068	1.054
TPG←TEE	0.371**	2.983	0.276***	4.868	0.156	1.697	0.333***	5.991
TIB← TQ	0.431***	3.627	0.497***	9.781	0.53***	7.3	0.46***	7.731
TIB← PQ	0.182	1.824	0.268***	6.303	0.256***	3.998	0.263***	5.334
TIB← IE	0.28**	3.164	0.126***	3.887	0.191***	4.033	0.103**	2.667

Path relation	Natural science		Humanities		Lower-grade		Upper-grade	
	Estimate	<i>t</i> -value	Estimate	<i>t</i> -value	Estimate	<i>t</i> -value	Estimate	<i>t</i> -value
TID← TIB	0.428***	6.941	0.635***	4.373	0.472***	6.249	0.54***	3.887
TPG←TIB	0.078	1.395	0.231	1.731	0.136*	1.985	0.104	0.805
TPG←TID	0.451***	10.929	0.468***	4.538	0.462***	10.079	0.423***	3.753
TEE←TIB	0.731***	15.923	0.78***	8.029	0.786***	15.876	0.687***	6.155
TID← TEE	0.104	1.751	0.026	0.193	0.078	1.067	0.171	1.358
TPG←TEE	0.308***	5.74	0.179	1.614	0.241***	3.738	0.374***	3.305
TIB← TQ	0.485***	9.504	0.523***	4.616	0.503***	9.241	0.445**	3.14
TIB← PQ	0.248***	5.894	0.25*	2.542	0.261***	5.723	0.314**	2.645
TIB← IE	0.14***	4.221	0.129	1.806	0.136***	3.915	0.091	1.016

Note: *Use initial capitalization to indicate the path relation in Table 9.

In the path that the emotional experience of teachers and students positively affects the psychological growth of tutor-student, there is a difference between gender and subject grouping, among them, female and natural subjects are significant, while male and humanities are not significant. From the foregoing, it can be seen that the majority of postgraduate students in medical colleges and universities are female in natural sciences. Therefore, considering that female pay more attention to the psychological growth brought about by the emotional interaction in the tutor-student relationship, to a certain extent, it is consistent with Harriet R's research, which also believes that in communicating with students, tutors should provide more "social emotional assistance" (emotional counseling, spiritual relaxation) to female students, and more "social tool assistance" (academic guidance, opportunistic challenge tasks) to male students.

In the path that postgraduate quality positively affects the tutor-student interactive behavior, there are differences between tutors and postgraduates, and the tutors are not significant on this path, it may be due to the cognition of the role of tutor, and the difference in the postgraduate quality will not adopt differentiated interactive behavior. In the path that the institutional environment positively affects

tutor-student interactive behavior, the lower-grade and the natural science groups pass the test, while the upper-grade and the humanities groups are not significant, it shows that the lower-grade groups who have just entered the school and the natural discipline groups that emphasize rational and logical thinking are more concerned about the institutional regulation of tutor-student interaction.

4.4 The Final Model Determination

Based on the hypothesis test results and analysis, the unverified path is deleted, and the model is finally obtained by verifying the empirical object, that is teachers and postgraduates in medical colleges or universities, as shown in Fig. 3.

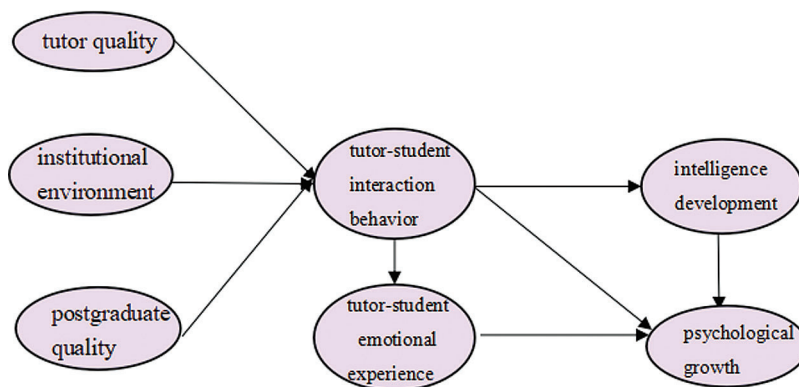


Figure 3: The model of the value of psychological education in the tutor-student relationship within medical universities or colleges

The model consists of seven variables in three dimensions of input, process, and result. Both teachers and postgraduates are featured with individual quality and cognitive characteristics, then the tutor-student interactive process is hereby developed by the driving effect of the institutional environment.

In the process of interaction, behavioral interaction and emotional communication serve as the core of promoting the value of psychological education in the tutor-student relationship. Both teachers and postgraduates affect intelligent development and psychological growth through positive interactive behavior, meanwhile, the emotional experience also plays a direct connecting role between the interactive behavior and psychological growth of teachers and postgraduates.

5 Conclusion and Discussion

5.1 Discussion and Implications

Concerning the matter of how Chinese postgraduates, especially in medical universities, give full play to the value of psychological education in the tutor-student relationship, and how to realize the comprehensive ability and psychological quality of teachers and postgraduates, this paper gives specific answers by empirical analysis of structural equation model.

1. From the perspective of input variables, the impacts of tutors' moral character and other psychological quality or ability on postgraduates' mental health should be noted. Differ from the intervention on postgraduates' mental health emphasized by general researches, the results of the multi-group analysis of this study show that the tutor group believes that the postgraduates quality doesn't affect the tutor-student interactive behavior, and the overall sample results show that tutor quality is the fundamental driving variable with the greatest impact. Relevant studies show that teachers with fine psychological qualities involving self-awareness, stable mood, and optimistic

attitude may imperceptibly affect postgraduates. The vital influencing indicators are defined as the tutor's academic attitude and scientific research level, which is based on the psychological quality of the tutor. On the one hand, on the premise of paying attention to their scientific research ability, an independent unit of "teachers' moral character investigation" is introduced in the selection and investigation of tutors, which is conducted in the form of self-questionnaire evaluation, questionnaire evaluation of direct contract personnel and random interview evaluation. Meanwhile, relevant psychological scales are introduced to measure and record the mental health status of tutors, all of these data may act as an important reference for tutor selection and the initial material of tutor ethics files. On the other hand, it is recommended to strengthen the training of tutors' mental health education and set up a "psychological counselor workshop" for them to face up to their mental health status, reflect on their academic attitude, and learn the correct way of psychological interaction and communication with postgraduates. Meanwhile, mastering the basic theoretical methods of psychological crisis intervention and psychological counseling of postgraduates is also suggested to give full play to the initiative of tutors in the psychological interaction between teachers and postgraduates, and play a positive role in promoting the academic research ability of postgraduates and guiding the physical and mental health of them.

2. From the perspective of process variables, teachers and postgraduates should pay attention to behavioral and emotional communication. Fine interpersonal interaction between them serves as the guarantee to improve the "soft power" of postgraduates' mental health and "hard power" of their scientific research level. On the one hand, it is possible to establish a bi-directional communication channel of online and offline cooperation, which ensures the online communication between tutors and postgraduates by developing the "online duty system" within the academic community, making it possible to share and discuss the difficulties encountered in academic development, daily living, job hunting, and other aspects. Meanwhile, teachers and postgraduates should be encouraged to conduct regular offline academic communication in the form of regular meetings and academic reports. The administrators of the college should hold regular non-academic extracurricular exchanges like "tea parties" to increase the frequency of communication. Postgraduates are also encouraged to talk to their tutors about the psychological pressure they face, to broaden the channels of communication between them in various ways, and create a fine atmosphere of communication. On the other hand, both teachers and postgraduates should encourage and learn from each other in the scientific research process on the premise of mutual trust and respect, and jointly deal with the academic issues encountered, especially in subjects where female postgraduates are predominant. Tutors should focus on adjusting their posture, changing their role from an authority to a counselor, and providing practical suggestions for postgraduates according to their varied psychological and personality demands. Besides, the sharing of resources and information with postgraduates can fully stimulate the research potential of both sides and realize the value of psychological education in the tutor-student relationship.
3. Considering the outcome variables, the academic achievements should be noted. As an important dimension of intellectual development, objective scientific research achievements positively affect the psychological growth of teachers and postgraduates. On the one hand, in the process of tutor-student cooperation, it should be noted to improve the completion efficiency and quality of scientific research projects. Relevant studies demonstrate that "confusing about the future after graduation" is considered an important factor leading to psychological pressure. Therefore, it might be possible to return to the essence of postgraduate education, namely cultivating high-quality scientific research talents. During the selection of scientific research projects, both sides should conduct full investigation and communication, formulate a reasonable schedule and carry out regular academic exchanges in the process of project implementation, to assist postgraduates

in improving objective scientific research strength and obtaining the competitiveness of career development. On the other hand, psychological guidance and material support are both required to improve the enthusiasm of postgraduates participating in scientific research projects. Colleges and universities may scientifically supervise and inspect the academic achievements of both teachers and postgraduates, stipulate the minimum limits of postgraduates participating in scientific research projects, and encourage them to independently set scientific research goals for each academic year by holding activities like “scientific research project challenge”, to exercise the enthusiasm and psychological resilience of postgraduates participating in scientific research projects. Meanwhile, it is also recommended to formulate incentive measures for the scientific research achievements, improve the scientific research treatment of postgraduates by improving the funding system, introducing enterprise and social resource support, and ensure the project cooperation between teachers and postgraduates, to achieve a win-win situation between the improvement of graduate education quality and the development of comprehensive quality and psychological ability of both teachers and postgraduates.

5.2 Research Limitations and Prospects

This paper provides theoretical and practical contributions to the research on the value of psychological education in tutor-student relationships, while there are still some shortcomings to be further explored. Firstly, due to the lack of literature on the value of psychological education in the tutor-student relationship, this paper refers to more research materials on the teacher-student relationship in the field of pedagogy in the factor extraction stage. There are supplements and improvements to be made in introducing more relevant psychological literature in the future to the formed factor system. Second, the medical colleges and universities are selected as the object in data collection, so whether the conclusion of the model validation applies to other disciplines of postgraduates remains to be discussed. In the future, it is possible to expand the scope of the questionnaire survey, and carry out the research on the value of postgraduate psychological education in general disciplines. Finally, the data collected in this research is cross-sectional data, and multi-stage tracking collection is not adopted in the research procedure. Although the data verification results show that the homology deviation is within an acceptable range, it is still possible to consider collecting data in stages to verify the model to further improve the accuracy of conclusions in the future.

5.3 Conclusion

Traditional psychological education for postgraduates is carried out in the form of class teaching, lecture-giving and psychological consultation. However, this paper focuses on the implicit value of psychological education in the tutor-student relationship, proposing that the tutor-student relationship, a complex and dynamic interpersonal interaction process, serves as an important way penetrating through the psychological education of postgraduates. Based on the self-designed value scale concerning psychological education in the tutor-student relationship, the structural equation model is applied for the first time to explore the composition of psychological education value in the tutor-student relationship and the impacts of each driving variable. The results of data analysis demonstrate that:

1. The model consists of three input variables including tutor quality, postgraduate quality, and institutional environment, two process variables involving tutor-student interactive behavior and emotional experience, and two outcome variables of tutor-student intelligence development and psychological growth.
2. The process variables, especially the interactive behavior, pose the greatest impact on the value of psychological education in the tutor-student relationship. The quality and frequency of communication between teachers and postgraduates, mutual trust, and respect serve as the key influencing indicators.

3. The input variables include tutor quality, postgraduate quality, and the institutional environment, which serve as the fundamental driving variables for the realization of the value of the relationship between the postgraduates and the teachers. Besides, the intermediary effect is detected in the path of “tutor quality → tutor-student interactive behavior → tutor-student intelligence development → tutor-student psychological growth”.
4. The objective results involving the quantity and quality improvement of scientific research achievements of teachers and postgraduates pose a positive impact on the indicators including comprehensive quality of both sides, the improvement of life satisfaction, the formation of psychological quality, and psychological growth.
5. In the path that affects the psychological growth of teachers and postgraduates, female groups mainly focusing on natural sciences pay more attention to the tutor-student emotional experience, while male and lower-grade groups pay more attention to behavioral interaction; In the path that affects the interaction between teachers and postgraduates, the tutor does not value the difference in the quality of graduate students, lower-grade and natural science professional groups pay more attention to institutional environment.

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