Research on the Quality Assurance Path of Academic Graduate Education

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Abstract. The study investigates the effect of tutor guidance, student maturity and university research environment on the quality assurance of the academic graduate education. A structural equation model was developed for an empirical test, based on teaching experience and Situational Leadership theory. A sample of 150 academic postgraduates in Shaanxi Province participated in the experiment. The results show: (1) All three factors are positively related to the quality of academic postgraduate education. (2) The guidance mode mostly affects the effect of the tutor guidance. (3) Among three elements of student maturity, the contribution of scientific attitude is the highest. (4) Compared with infrastructure, the institutional system and campus culture can more effectively represent the research environment of a university. In order to effectively guarantee the quality of academic graduate education, the three main bodies, universities, tutors and postgraduates, must have a joint effort.

1. Introduction

As the highest level of academic education, graduate education is the key to reflect the quality level of higher education. Graduate education in our country is divided into academic type and specialized type, in which the professional type focuses on the application, and the academic type mainly focuses on the theoretical research. On the basis of clearly defining the connotation of educational quality of academic graduate students, this paper attempts to use structural equation model to quantitatively study the influencing paths of the three main subjects in the process of quality training, namely, tutor, student and university, and puts forward some suggestions for this purpose, and finally enrich the academic graduate training quality of quantitative research results.

2. Theoretical basis and hypothesis to be verified

2.1. Definition of the quality of academic postgraduate education

The quality of higher education is not a unified concept, and the focus of different interest groups may be different. For example, students and teachers focus on the education process, while employers may focus on the output of higher education [1].Yuan Bentao pointed out that the quality of post-graduate education referred to the quality of graduate students' thesis in a narrow sense, and in a broad sense was the overall development of graduate students' moral, intellectual, physical and aesthetic [2].Sheng Mingke defined the quality of postgraduate education as the sum of a set of characteristics inherent in graduate education in a given environment and context, which satisfied the needs of individual, social and disciplinary development of graduate students.[3]Zeng Liying believed that under the background of "China creation", it was very important to guide graduate students to realize the transformation
from profession to ambition [4]. Therefore, the biggest difference between academic graduate education and others is that we should cultivate talents who have spirit of science [5].

Therefore, the article defines the quality of academic postgraduate education as the quantity and quality of the papers published by postgraduates in universities, the level of scientific research, and the shaping of scientific spirit. The study will focus on the three most directly involved subjects in the process of postgraduate training: tutors, graduates themselves, and universities.

2.2. Theoretical analysis and hypothesis

2.2.1. Tutor guidance effect and academic graduate education quality. The widespread adoption of the "tutorial system" in graduate education in various countries has made the tutor the first responsible person in the process of postgraduate education. Some empirical studies have shown that mentoring factors have varying degrees of influence on scientific research achievements and scientific research outputs of academic graduate students in school, and that the younger the mentor, the higher the title, the better the students' scientific research performance [6]. In addition, some scholars have mentioned the necessity of establishing a healthy relationship between teachers and students [7-8].

Based on the purpose of the study, we argue that, as a tutor, the goal should be to provide students with high-quality guidance. Tutor's academic ability, guiding way and sense of responsibility are the main factors that affect the guidance effect. Based on this, the paper proposes the hypothesis1 (H1): the effect of tutor guidance has a significant influence on the quality of academic graduate education.

2.2.2. The student maturity and the quality of academic graduate education. Combined with the definition of the subordinates maturity in Situational Leadership theory, the degree to which the individuals have the ability and will to do the work is called the subordinate maturity. Applying this theory to academic graduate education, the ability and willingness of the graduates to do the research is described as maturity. Some studies have shown that students' initiative is not only the biggest factor contributing to the innovation ability of academic graduate students, but also can improve the effect of tutors' guidance. [9]. The enrollment of graduate students has expanded, so that more people have chance to receive higher education at graduate level. However, the quality of postgraduate education is difficult to guarantee. Some graduate students are in a state of confusion, passively doing research, unwilling to spend their time studying the various methodologies and theoretical foundations required for scientific research. Therefore, non-standard, weak theoretical support, no contribution to the situation of the paper is expected.

Therefore, the article believes that the graduates' knowledge base, attitude to scientific research and energy should not be ignored. Based on this, we propose hypothesis 2 (H2): students maturity has a significant influence on the quality of academic graduate education.

2.2.3. University research environment and academic postgraduate education quality. Ling Yunxiang has studied the quality of postgraduate education under teaching and research sections [10], this article takes the whole university environment as the research object, discusses from which aspect can construct the effective research environment. In addition to the physical conditions, the cultural systems are the implicit rules for guaranteeing the quality[11]. The article believes that the various kinds of infrastructure play a fundamental role, the campus culture plays a role in shaping, and the institutional system plays a binding role. They jointly build a research environment for universities According to this, the article puts forward hypothesis 3 (H3): the research environment of the school has a significant influence on the quality of academic postgraduate education.

3. Model construction and research design

3.1. Model construction
The structural equation model (SEM) was used to study the problem. On the basis of reading papers and combing with practical teaching experience, the authors first extracted three observation variables. That is, the graduate's academic level, the quality and quantity of papers, and scientific research spirit.

Then, the academic ability, the way of guidance and the sense of responsibility were used to measure the guidance effect of the tutor. The students' knowledge base, attitude towards scientific research and energy were used to measure the maturity of the graduates, and the infrastructure, system and campus culture were used to measure the scientific research environment of the university.

The structural equation model of the quality guarantee path of academic graduate education is shown in Figure 1. Among them, the meaning represented by $X_1$-$X_{12}$ is marked in the model, $e_1$-$e_{12}$ is the residual of observation variable, and $e_{13}$ is the residual of latent variable. Default their non-standardized path coefficients to 1 to ensure that the model can be identified smoothly.

### 3.2. Research design

#### 3.2.1. Questionnaire design.

This paper designed a scale specifically aimed at the quality of academic graduate education. In order to ensure that respondents feedback the real situation, the statement had carefully considered the accuracy of the language expression to ensure that the questions were understood. The scale was designed by Likert (Richter) five-grade scoring method.

#### 3.2.2. Data collection.

A questionnaire survey was conducted among some academic postgraduates in three universities in Shaanxi province. 150 questionnaires were sent out and recovered, 140 valid questionnaires were obtained. The effective recovery rate was 93.33%, which met the requirements of sample analysis. Regression analysis was used to test the reliability and validity of the questionnaire, maximum likelihood estimation was used to calculate the model, and SPSS23.0, AMOS23.0 were used as the main analysis tools.

![Figure 1. The quality assurance model of academic postgraduate education](image)

### 4. An empirical analysis on the quality assurance of academic postgraduate education

#### 4.1. Reliability and validity analysis

4.1.1. Reliability analysis. In this paper, the 12 observed variables and 4 latent variables in the quality assurance model of academic postgraduate education are measured by SPSS23.0 software. The results
are shown in Table 1. The Cronbach’s Alpha coefficients of the four latent variables are 0.680, 0.637, 0.649 and 0.626, respectively. The reliability of the total quantity table is 0.768, indicating that the questionnaire has a higher reliability.

Table 1. Questionnaire reliability analysis.

| Latent variables                     | Observation variables | Cronbach’s alpha |
|--------------------------------------|-----------------------|------------------|
| Tutor guidance effect                | X1-X3                 | 0.680            |
| Student maturity                     | X4-X6                 | 0.637            |
| University research environment      | X7-X9                 | 0.649            |
| Academic postgraduate student education | X10-X12              | 0.626            |
| General scale                        | X1-X12                | 0.768            |

4.1.2. Validity analysis. Used Spss23.0 to carry out Bartlett spherical test and KMO value analysis to explore the suitability of making factor points (Table 2). The results shows that the P-value is 0.000 and passes the Bartlett spherical test. The KMO value is 0.775 and more than 0.70, which indicates that the validity of the data is high, and it is suitable for factor analysis.

Table 2. KMO values and Bartlett spherical test.

| KMO value | Bartlett’s Approximate chi-square | Free degree | Conspicuousness |
|-----------|----------------------------------|-------------|----------------|
|           |                                  | 361.605     | 66             | 0.000           |

Through exploratory factor analysis with principal component analysis, four common factors with an interpretation rate of 61.65% for the whole questionnaire were successfully extracted, which were in good agreement with the presupposed latent variables (Table 3). The standardized factor load values of the 12 observed variables are between 0.593 and 0.783, greater than 0.5, indicating that the structure validity of each variable is good.

Table 3. Exploratory factor analysis.

| Observation variables                     | Factor loading |
|-------------------------------------------|----------------|
| Academic ability (X1)                     | 0.728          |
| Guidance mode (X2)                        | 0.724          |
| Responsibility (X3)                       | 0.781          |
| Knowledge base (X4)                       | 0.701          |
| Scientific attitude (X5)                  | 0.725          |
| Endeavor (X6)                             | 0.783          |
| Basic facilities (X7)                     | 0.704          |
| Institutional system (X8)                 | 0.736          |
| Campus culture (X9)                       | 0.761          |
| Academic level (X10)                      |                |
| Quantity and quality of papers (X11)      | 0.732          |
| Scientific research spirit (X12)          | 0.768          |

4.2. Test of suitability of structural equation model
The above results show that it is suitable for SEM analysis. We used AMOS23.0 and selected ten statistics to test the model fitting degree. The results are shown in Table 4.
Table 4. Model global fitness test.

(a) Indicators | Test statistic | Model results | Fitness criteria or threshold values | Result
--- | --- | --- | --- | ---
Absolute fitness indexes | $\chi^2$/df | 1.154 | $1 < \chi^2$/df$<2$ | Excellent
 | RMR | 0.034 | $<0.05$ | Excellent
 | RMSEA | 0.034 | $< 0.08$ | Excellent
 | GFI | 0.929 | $> 0.90$ | Excellent
Value-added fitness indexes | NFI | 0.846 | $> 0.90$ | Good
 | CFI | 0.975 | $> 0.90$ | Excellent
 | IFI | 0.976 | $> 0.90$ | Excellent

(b) Simplicity fitness indexes | PNFI | 0.641 | $> 0.50$ | Excellent
 | PGFI | 0.596 | $> 0.50$ | Excellent
 | AIC | 113.681 | $< 398.63$ | Theoretical model values are smaller than independent model values and saturated model values | Excellent

Except NFI is 0.846, which is slightly less than the threshold value of 0.9, other fitting optimization indexes all meet the critical value standard, which shows that the overall fit and fitness of the structural equation model designed have passed the test.

4.3. Model estimation results and analysis

4.3.1. Measurement model shows covariant effect between potential variables and observed variables. According to the standardized path coefficients shown in Table 5, the relationship between latent and observed variables in the model is summarized as follows: 1) The tutors' guidance method (0.690) is the most important during the academic postgraduate cultivation. 2) The investigation of students maturity is mainly based on their scientific attitude (0.824) and endeavor (0.580). Although knowledge base (0.403) is important, they cannot achieve high-quality academic performance if lack of right attitude and continuous endeavor. 3) The systems of universities (0.846) can more effectively shape the overall research environment. 4) The observed variables contributing to the quality of academic graduate education are the cultivation of scientific spirit (0.657), the comprehensive academic level (0.622) and the quantity and quality of papers written (0.534).

4.3.2. The relationship between the reactive latent variables in structural equation model. According to the standardized path coefficient, the value of tutor's guiding effect, the students maturity and the research environment to the quality of academic graduate education are 0.305, 0.295, 0.412, respectively. All of them pass the significance test at the confidence level of 0.05. Therefore, the three hypotheses (H1, H2, H3) of this paper are verified. In addition, the covariance between the research environment and the tutor guidance is the largest, 0.155, and the lowest is between the student maturity and the school research environment, only 0.04. In conclusion, the interaction between exogenous latent variables is small.
Table 5. Model of structural equation, standard regression path coefficient.

(a) Non-standardized estimation results

| Path                                      | Estimated value | Standard error | Critical ratio | Normalized path coefficient estimation results |
|-------------------------------------------|-----------------|----------------|----------------|-----------------------------------------------|
| Quality of academic postgraduate education ← Tutor guidance | 0.250*           | 0.126          | 1.983          | 0.305                                         |
| Quality of academic postgraduate education ← Student maturity   | 0.412*           | 0.194          | 2.128          | 0.295                                         |

(b) Normalized results

| Path                                      | Estimated value | Standard error | Critical ratio | Normalized path coefficient estimation results |
|-------------------------------------------|-----------------|----------------|----------------|-----------------------------------------------|
| Quality of academic postgraduate education ← University research environment | 0.311**          | 0.106          | 2.934          | 0.412                                         |
| X₁ ← Tutor guidance                       | 1.000           |                |                | 0.609                                         |
| X₂ ← Tutor guidance                       | 1.005***         | 0.191          | 5.254          | 0.690                                         |
| X₃ ← Tutor guidance                       | 0.858***         | 0.166          | 5.162          | 0.652                                         |
| X₄ ← Student maturity                     | 1.000           |                |                | 0.403                                         |
| X₅ ← Student maturity                     | 1.830***         | 0.499          | 3.666          | 0.824                                         |
| X₆ ← Student maturity                     | 1.209***         | 0.322          | 3.758          | 0.580                                         |
| X₇ ← University research environment      | 0.548***         | 0.103          | 5.330          | 0.523                                         |
| X₈ ← University research environment      | 1.000           |                |                | 0.846                                         |
| X₉ ← University research environment      | 0.949***         | 0.160          | 5.936          | 0.638                                         |
| X₁₀ ← Quality of academic postgraduate education | 1.000         |                |                | 0.622                                         |
| X₁₁ ← Quality of academic postgraduate education | 0.773***         | 0.166          | 4.660          | 0.534                                         |
| X₁₂ ← Quality of academic postgraduate education | 1.291***         | 0.245          | 5.275          | 0.657                                         |

5. Conclusion and suggestion

5.1. Conclusion

This article took the academic graduate education quality assurance as the research object. By constructing the structure equation model, we probed into and verified the three most direct subjects, the tutors, the graduates and the universities, which played a positive role in the process of quality assurance. The results propose that the tutor’s academic ability, guidance and responsibility for student development will affect the guiding effect. And students should focus on and devote more energy to research. Although the infrastructure required for research is also essential, a series of management systems enable students to face up to the importance of scientific research and guide tutors to invest more energy to teach students. The campus culture with scientific spirit will affect the value orientation of graduates and then change their behavior.

5.2. Suggestion

5.2.1. Tutor level. The tutor can learn from the Situation Leadership theory of Hesse and Blanchard. The order and support behavior can be adjusted according to the postgraduates' different job and psychological maturity. Secondly, tutors should have a sense of responsibility for educating people. To achieve this effect, the quality assessment of graduates should be linked to the tutor's assessment.
5.2.2. Individual level of graduate students. At present, the selection of academic postgraduates in China pays more attention to whether or not knowledge has passed, and the lack of effective investigation of scientific research will make it difficult to ensure that graduates are fully engaged in academic research after entering the university. Therefore, tutors, universities should guide postgraduates to establish a positive attitude towards scientific research as soon as possible, so that students can mature psychologically as soon as possible. Secondly, achieving high-quality academic research must require researchers to devote a great deal of time and energy. Therefore, students themselves should improve scientific literacy, and mature in their abilities.

5.2.3. University level. First of all, we should establish and improve various training and management systems to improve the service quality of graduate education, adjust and optimize the curriculum, and help academic graduate students prepare for the theory and method of academic research. Secondly, the campus culture with the value orientation of loving research and scientific spirit should be established. In addition, the university should provide basic research conditions and infrastructure to ensure steady improvement in the quality of postgraduate education.

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