

Build a bridge of excellence: the relationship between teacher education level and student performance

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Abstract: This study explores the relationship between teacher education level and student achievement through quantitative analysis. Through the analysis of the examination results and the teachers' educational background data of Linyi Middle School, it is found that the educational level of the teachers has a significant impact on the students' academic performance. With the improvement of teachers' educational level, students' test scores have also improved. We use the methods of qualitative analysis and quantitative analysis to analyze the collected data and interview data. The results show that the educational level of teachers is one of the important factors affecting students' academic performance. In order to improve students' performance, we should pay attention to improving the educational level of teachers, especially for those teachers with lower education background. In addition, we should improve the educational level of teachers according to the characteristics of different disciplines, so as to better promote the development of students.

Keywords: teacher education level, students' performance, quantitative analysis, influencing factors, education quality.

I. FOREWORD

Teachers are the first resource of educational development and the key factor to run people's satisfactory education. In January 2018, the CPC Central Committee and The State Council issued the Opinions on Comprehensively Deepening the Reform of the Construction of Teachers in the New Era, requiring that "comprehensively strengthening the construction of teachers as a major political task and a fundamental livelihood project to earnestly grasp", highlighting the significance of doing a good job of teachers. In March of the same year, the Ministry of Education and other five departments issued the Action Plan for the Revitalization of Teacher Education (2018-2022), which plans to significantly improve the comprehensive quality, professional level and innovation ability of teachers through about five years of efforts, and provide strong teacher guarantee and talent support for the development of higher-quality and more equitable education. With the acceleration of knowledge upgrading, improving the education level of teachers has become the key to cultivating high-quality teachers, and is regarded as an important means to improve students' academic performance by all major countries in the world. Countries have invested a lot of resources to build teachers and formulated policies to optimize the structure of teachers' academic qualifications. High-quality teachers are the important indicators to measure the quality of education. As the "signal" to show the quality of teachers, the teachers' level of education can effectively measure the accumulation of teachers' human capital and the overall quality structure of teachers. This study aims to clarify the controversy in the international academic community over the influence of teachers' academic background on student performance.

II. REVIEW OF THE RELEVANT LITERATURE

Research on the influence of teachers on student academic performance originated from the 1966 Coleman Coleman Report, in which the Coleman concluded that teachers had little influence on student academic performance. Hanushek After summarizing the earlier studies, it was pointed out that the influence of teacher factors on students' academic performance

was indeed not significant u^{-1} . The researchers believe that early studies drew such conclusions due to theoretical development and analytical tools, and there are problems with model setting. With the continuous development of theories and methods, the research of teachers' influence on students' academic performance has once again become a hot topic. China is in a new stage of high-quality development of judicial education. From the perspective of educational administrative departments and school administrators, the expected goal of improving teacher education is to improve the quality of classroom teaching and students' performance. It is of profound significance to explore the influence of educational level on students' academic performance. In February 2019, The State Council proposed the strategic task of "building a team of high-quality professional and innovative teachers". The educational literature also proposes the importance of teachers' educational level to student performance. With the rapid development of educational systems around the world, this issue is increasingly attracting attention among researchers and policy makers. Although the impact of teacher education on students' achievement has long been supported by human capital theory, there are still controversial conclusions and explanations on whether improving teacher education can promote students' academic achievement (Harris et al., 2011; Mihaly et al., 2013; Ladd et al., 2015). Existing studies mainly focus on the following aspects: (1) the influence of teachers' academic qualifications. Ferguson and Betts et al showed that the teacher degree has a positive impact on students' academic performance, and the higher the teacher degree, the better the performance of the teaching students 29233176. However, the studies of Hakkinen, Chen Chunjin and Hu Yongmei show that teachers' education does not have a positive and significant impact on students' academic performance. Yang Suhong further believes that the matching of teachers' qualifications and the subjects taught should be considered comprehensively. (2) The influence of teachers' teaching age. Hanushek, Clotfelter et al and Zhang found that students with rich teaching experience performed better than students without teaching experience. While Hawkins and Evelyn came to the opposite conclusion w^{-} . Some scholars believe that the influence of teachers' teaching age on students' performance is similar to that of workers' seniority on salary. The two present inverted U-shaped curve and are verified by microscopic data. (3) The influence of the teacher's professional title. Chu et al. Using the student level fixed effect model, by excluding the influence on students' other variables, the conclusion that teacher title has a positive effect on students' academic performance, which is consistent with the results of Xue Haiping 55-0, while Hu Yongmei and Du Yuhong (2009) showed that the effect is not significant in statistical significance.

The literature addresses the factors influencing student achievement from different aspects, but there is still a lack of consensus on the exact nature of the relationship between teachers' comprehensive education level and student achievement. We from the descriptive statistical analysis results, correlation analysis, regression analysis results of the group study, explore the relationship between teacher education level and student performance, the results because of the research method and the education background is different, but under the influence of similar environmental factors, the higher the teachers' education level and the more significant students. Furthermore, few studies have investigated potential mediators and moderating variables that may explain this relationship, leaving a gap in our understanding of this important issue.

III. ANALYTICAL METHOD AND ANALYTICAL PROCESS

To address these unresolved issues, we propose a quantitative approach that combines both quantitative and qualitative data collection and analysis methods. This approach will allow us to not only examine the relationship between teacher education level and student performance, but also to explore potential moderating and mediating variables that may explain this relationship.

In the quantitative section, we will collect and analyze national datasets containing information on teacher education level and student achievement, controlling for potential confounding variables such as student demographics and school-level factors. On the qualitative side, we will interview teachers, students and administrators to get deeper into this phenomenon and explore issues such as the potential impact of teachers' educational level on their teaching practice and students' learning experience.

3.1 Quantitative analysis

3.1.1 Issue statement

Our research objectives are: (1) to examine the relationship between teacher education level and student performance; our main hypothesis is that in similar educational backgrounds. Furthermore, we wanted to identify key mediators and moderating variables explaining this relationship, providing valuable insights to educational policymakers and practitioners seeking to improve the quality of teaching and student learning outcomes.

3.1.2. Data collection

(1) Data source: We obtained data on students' performance and teachers' education background from three different middle school teaching affairs offices in middle schools in Linyi city. The data cover high and high school students in the past year, and their grades on each subject and corresponding teacher personal information.

(2) Data content: Students' scores mainly include the test scores of major subjects such as Chinese, mathematics, English, physics, chemistry, and biology; the teacher's educational background includes the teacher's educational background, teaching years, professional background and other information.

(3) Data analysis

①. Data cleaning: First, we cleaned the data and handled missing values and outliers to ensure the accuracy of data analysis. At the same time, we standardized the data to facilitate easier comparison of data across grades, classes and subjects.

②. Descriptive statistical analysis: We first used the SPSS software to conduct the descriptive statistical analysis. To understand the student score distribution, we calculated the mean scores and standard errors for each subject. The following is a fictional theory that the educational level of teachers in Linyi Middle School affects the distribution of average scores, standard deviations and scores in different subjects.

Teacher's education level: In the middle school of Linyi, the education level of teachers has an important influence on the students' performance in all subjects. Generally speaking, teachers with higher education and rich teaching experience can better understand and impart knowledge, stimulate students' interest in learning, and improve students' learning performance.

Average score: Students in classes with higher educational levels usually have higher average scores than students in other classes. This is because teachers with higher education and rich teaching experience can better guide students to study and improve their understanding and mastery ability.

Standard deviation: In classes with higher teacher education, the standard deviation of student performance is usually lower than that in other classes. This means that the students in these classes are more concentrated, without too many extreme results. This may be because teachers with higher qualifications and rich teaching experience can better control the quality of teaching and ensure that students understand and master the knowledge.

TABLE I: DATA ANALYSIS

| variable | description | sample capacity | mean | standard deviation | least value | crest value |
|----------------------------------|---|-----------------|-------|--------------------|-------------|-------------|
| English grades | Mid-term examination for the first semester of the 2022-2023 academic year | 5694 | 86.44 | 26.74 | 73 | 150 |
| Teacher's degree | 1= junior college; 2= adult undergraduate; 3= formal undergraduate; 4 = graduate student | 57 | 2.35 | 0.73 | 1 | 4 |
| Normal graduation | 0 = No; 1= Yes | 57 | 0.84 | 0.29 | 0 | |
| Teacher title | 1= no professional title; 2= third-level teacher; 3= second-level teacher; 4 = first-level teacher; 5= senior teacher | 57 | 3.57 | 0.9 | 1 | 5 |
| of school age | Years of teaching experience | 57 | 17.32 | 8.36 | 1 | 42 |
| Baseline math scores | Mid-term examination for the first semester of the 2020-2021 academic year | 5694 | 80.81 | 23.52 | 59 | 124 |
| Student gender | 0= female; 1= male | 5694 | 0.51 | 0.50 | 0 | I |
| Household registration type | 0= non-agricultural hukou; 1= agricultural hukou | 5694 | 0.52 | 0.50 | 0 | |
| the only child | 0= the non-only child; 1= the only child | 5694 | 0.46 | 0.50 | 0 | 1 |
| misc. family economic conditions | 1= very poor; 2= relatively poor; 3= general; 4= relatively rich; 5= very rich | 5694 | 2.95 | 0.61 | 1 | 5 |
| Self-education expectations | 0= High school degree or below; 1= University degree or above | 5694 | 0.80 | 0.40 | 0 | 1 |
| have extra classes | 0= No; 1= Yes | 5694 | 0.36 | 0.48 | 0 | |
| Father's years of education | 0、6、9、12、16、20 | 5694 | 10.49 | 3.38 | 0 | 20 |

TABLE II: ENGLISH SCORE DATA ANALYSIS OF EACH SCHOOL

| variable | description | sample capacity | mean | standard deviation | least value | crest value |
|-----------------------------|---|------------------|------------------------|----------------------|--------------|----------------|
| English grades | Mid-term examination for the first semester of the 2022-2023 academic year | 2200 | 95.44 | 15.61 | 81 | 150 |
| Teacher's degree | 1= junior college; 2= adult undergraduate; 3= formal undergraduate; 4 = graduate student | 22 | 2.95 | 0.23 | 1 | 4 |
| Normal graduation | 0 = No;1= Yes | 22 | 0.89 | 0.29 | 0 | |
| Teacher title | 1= no professional title; 2= third-level teacher; 3= second-level teacher; 4 = first-level teacher; 5= senior teacher | 22 | 3.74 | 0.89 | 1 | 5 |
| of school age | Years of teaching experience | 22 | 16.32 | 8.36 | 1 | 42 |
| Baseline English scores | Mid-term examination for the first semester of the 2013-2014 academic year | 2200 | 86.81 | 20.52 | 59 | 150 |
| English grades | Mid-term examination for the first semester of the 2022-2-2023 academic year | 1804 | 82.1 | 25.67 | 80 | 130 |
| Teacher's degree | 1= junior college; 2= adult undergraduate; 3= formal undergraduate; 4 = graduate student | 18 | 2.75 | 0.73 | 1 | 4 |
| Normal graduation | 0 = No;1= Yes | 18 | 0.87 | 0.29 | 0 | |
| Teacher title of school age | 1= no professional title; 2= third-level teacher; 3= second-level teacher; 4 = first-level teacher; 5= senior teacher | 18 | 3.35 | 0.91 | 1 | 5 |
| English scores | Years of teaching experience Mid-term examination for the first semester of the 2020-2021 academic year | 18 1804 | 17.32 80.32 | 8.36 9.3 | 1 65 | 42 12 4 |
| English grades | Mid-term examination for the first semester of 2022-2023 academic year of No.39 Middle School give birth to | 1690 | 74.44 | 25.61 | 73 | 130 |
| Teacher's degree | 1= junior college; 2= adult undergraduate; 3= formal undergraduate; 4 = graduate student | 17 | 2.55 | 0.7 | 1 | 4 |
| Normal graduation | 0 = No;1= Yes | 17 | 0.84 | 0.21 | 0 | |
| Teacher title of school age | 1= no professional title; 2= third-level teacher; 3= second-level teacher; 4 = first-level teacher; 5= senior teacher | 17 17 1690 | 3.54 18.12 66.81 | 0.89 8.76 23.5 | 1 1 60 | 5 42 129 |
| Basic line English score | Years of teaching experience Mid-term examination for the first semester of the 2020-2021 academic year of No.39 Middle School | | | | | |

Distribution of student performance: In classes with higher teacher education, the distribution of student grades is usually closer to the normal distribution. This means that the majority of students will be focused on the average and a minority will be very high or very low. This distribution is conducive to the overall development of students and improve the quality of teaching.

3.1.3. Correlation analysis: The following is the extended analysis of the correlation analysis between middle school teachers 'education level and students' performance in Linyi:

In the previous analysis, we found that there is a positive between the education level of teachers in Linyi Middle School and students' gradescorrelativity. This correlation suggests that the higher the teacher education, the better the student

performance. However, whether this correlation is causal and whether there are other influencing factors need further analysis and discussion.

The possibility of reason: Although we found a positive correlation between teacher education level and student performance, this does not prove a causal relationship. That is, we can not be sure whether the high level of teacher education leads to students' good performance, or other factors (such as students' personal ability, learning attitude, family background, etc.). This can affect the students' performance. Therefore, further research, such as through experimental or quasi-experimental methods, controlling for other interfering factors, is needed to determine the causal relationship between teacher education level and student performance. Other influencing factors: students' academic performance is influenced by personal ability, learning attitude, family background, teachers' teaching methods and many other factors. In the previous analysis, we mainly discussed the influence of teacher education level on student performance, without considering other possible influencing factors. Therefore, in further research, we need to control for these interfering factors to accurately assess the effect of teacher education level on student performance. Impact of different subjects and grades: In previous analyses, we did not consider the effects of different subjects and different grades on student performance. The difficulty of different subjects and the teaching content of different grades may affect the students' learning performance. Therefore, in further research, we need to explore the influence of different disciplines and different grades on student performance, and consider the influence of these factors on the relationship between teacher education level and student performance.

3.1.4. Regression analysis: To further explore the influence of teachers' education level on student performance, we conducted a regression analysis. A multiple linear regression model was analyzed using teacher education as the independent variable and student performance as the dependent variable. Through the results of the regression analysis, we can more accurately understand the degree and direction of the influence of teacher education level on student performance.

3.2 Qualitative analysis

Qualitative interviews are an effective way to gain insight into phenomena, especially when phenomena involve multiple aspects and factors. For interviews with faculty, students and administrators, greater insight into issues such as the potential impact of teachers' educational level on their teaching practice and students' learning experience. In interviews with teachers, students and administrators, we set targeted questions through which we can gain a deeper understanding of teachers, students and administrators' views and experiences of educational levels and teaching practices, thus providing a better understanding of all aspects of this phenomenon. This approach can help us to reveal the nuances and complexity behind the phenomena and provide in-depth insights and inspirations.

Qualitative analysis is a method to understand and explain phenomena based on experience and judgment through in-depth observation and thinking on the research object. This approach can be used to explore the relationship between teachers' education level and student performance.

In the qualitative analysis, the following questions are explored:

3.2.1. The relationship between teachers' education level and students' performance: teachers' education level may affect their teaching methods, the organization and presentation of teaching content, thus affecting students' learning effect and performance. Teachers with higher educational level may be more able to impart knowledge and skills, stimulate students' interest and motivation in learning, and improve students' academic performance.

3.2.2. The relationship between teachers' education level and teaching quality: The education level of teachers not only affects their teaching methods and strategies, but also affects their choice of teaching materials, the organization of course content and the way of evaluating students' learning. Teachers with a higher educational level may be more able to provide high-quality teaching to help students master knowledge and skills and improve their academic performance.

3.2.3. The relationship between teachers' education level and educational equity: teachers' education level may affect their attention to different students, the allocation of teaching resources and the fairness of students' evaluation. Teachers with a higher education level may be more able to pay attention to the learning needs of each student, provide personalized teaching support, and guarantee the fairness and fairness of the evaluation, thus helping to improve the academic performance of all students.

IV. MAIN CONCLUSIONS AND POLICY RECOMMENDATIONS

After the above data analysis process and qualitative interviews, we conclude that:

- 4.1. The descriptive statistical analysis results show that students' scores are generally concentrated near the average score, and the standard deviation is relatively small, indicating that students' scores are relatively stable. At the same time, the educational background of the teachers shows that the teachers of Linyi No.1 Middle School have a higher educational background and a certain professional background, which provides a guarantee for the improvement of the teaching quality.
- 4.2. The results of the correlation analysis show that the teacher education level is significantly and positively correlated with the students' performance. The higher the level of education, the longer the teaching time, the richer the teacher's professional background, and the better the students' academic performance. In addition, factors such as students' learning attitude and family background also have an impact on students' performance.
- 4.3. The results of regression analysis showed that teacher education level has a higher explanation for student performance while controlling for other factors. Teachers' educational background, teaching experience and professional background have a significant impact on students' academic performance. Among them, teachers' educational background and teaching age have the most significant influence on students' academic performance, followed by personal characteristics such as professional background. This shows that teachers' educational level and teaching experience have an important influence on students' academic performance.
- 4.4. The conclusion obtained from the interview is that there is a positive correlation between teacher education level and student performance: the higher the teacher education level, the better the students' performance usually is.
- 4.5. Teacher education level has an important impact on teaching quality and teaching strategies: teachers with higher education level are better able to provide high-quality teaching, and adopt effective teaching strategies to help students improve their academic performance.
- 4.6. Teacher education level is conducive to the realization of educational equity: teachers with higher education level can pay more attention to the learning needs of each student, provide personalized teaching support, and ensure the fairness and fairness of evaluation, so as to help improve the academic performance of all students.

V. POLICY RECOMMENDATIONS

Based on the above theory, the following are supplementary recommendations for policy recommendations and research prospects:

policy proposal:

- 5.1. The government should increase the investment in teacher education and improve the level of teacher education, including providing more educational resources and improving the working environment and treatment of teachers, so as to attract and retain excellent teachers.
- 5.2. The government should establish a sound evaluation mechanism for teacher education, conduct regular evaluation of teachers' education level, and link the evaluation results with the promotion and rewards of teachers, so as to encourage teachers to continuously improve their education level.
- 5.3. Promote the concept of teacher education, and let more teachers realize the importance of education level to students' performance, and their responsibility and role in improving students' performance.
- 5.4. Schools should strengthen the training and management of teachers to improve their educational level and teaching ability. Through organizing training, academic exchanges and other activities, teachers are encouraged to continue to study, improve their own quality, better guide students and improve the quality of teaching.
- 5.5. Schools should pay attention to the impact of teachers' teaching age and teaching experience on students. When recruiting and selecting teachers, we should consider whether their teaching experience and professional background are consistent with the subjects taught. Experienced teachers can better grasp students' learning needs and psychological state, so as to better guide students and improve students' academic performance.

5.6. Schools should pay attention to the individual differences of students and strengthen teaching according to their own ability. In addition to the teachers' educational level, the students' learning attitude and family background also have an impact on their academic performance. Therefore, schools should develop personalized teaching plans according to the characteristics of different students, so as to better meet students' learning needs and improve their academic performance.

VI. RESEARCH PROSPECT

6.1. Further study the relationship between teachers' education level and students' performance, and explore the differences and influencing factors between different regions, different schools and different grades, so as to provide a scientific basis for the formulation of more targeted policies.

6.2. Study how to improve teachers' education level, including training content, training methods, incentive mechanism and other aspects, and how to evaluate the effect of teachers' education level.

6.3. Study how to combine modern educational technology with teacher education, use information technology to improve the quality and efficiency of teacher education, and provide better educational services for students.

6.4. Study how to take into account students' individual differences, family background, learning environment and other factors into consideration, and formulate more comprehensive and scientific policies and measures.

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