

Research on the current situation of diversified development in education

Zhengjie Fu^{1,*}, Wenrui Lu², Wenli Xu³, Kaili Jiang²

¹School Of Economics And Management, Anqing Normal University, Anqing, China, 246133

²School Of Mathematics And Physics, Anqing Normal University, Anqing, China, 246133

³School Of Electronic Engineering And Intelligent Manufacturing, Anqing Normal University, Anqing, China, 246133

*Corresponding author: fzj020726@163.com

Abstract. As a multicultural country, China's education industry is at a critical stage of development. It not only contributes to the diversity of society, but also improves the overall quality of the entire population, thereby improving the basic scientific literacy of all people and improving their physical and mental health. However, due to various reasons, especially history, social environment and current economic conditions, there are still many challenges in the current education, especially the lack of resources related to mathematics education. With the change of times, improve the quality of students; Learning interest and skills in mathematics, as well as strengthening their understanding of mathematical culture and theory, are important issues today; Therefore, integrating these factors into the classroom not only helps to improve their comprehensive quality, but also helps to better realize their dreams. This paper aims to explore the sustainable development of minority mathematics education through practical activities, classroom discussions, examination guidance, social practice activities and other forms, so as to improve students' comprehensive quality and mathematical ability.

Keywords: Reliability Analysis, Validity Analysis, Principal Component Analysis.

1. Introduction

Mathematics education has always been an important part of education. Although the scale and quantity of education for ethnic minorities have improved significantly in recent years, many challenges remain in terms of the quality and level of education, especially in remote areas [1]. Since the reform and opening up, the state has attached great importance to the education of ethnic minorities, which has also attracted the attention of all sectors of society and made a series of achievements. Due to differences among ethnic groups in living habits, language, mathematical resources, mode of thinking, mathematical values, and economic level, mathematics education lags behind significantly, making students' mathematics performance significantly lower than the national average [2]. There are still some outstanding problems in the mathematical education of minority nationalities in our country. Not only are the performance in mathematics poor, but the core literacy in mathematics is low [3]. Objectively speaking, mathematics contains a lot of abstract things, such as formulas and concepts. In the face of abstract and formal mathematics language, as well as significant racial differences that can not be ignored, the mathematics education of ethnic minorities is inherently inadequate, and has obvious disadvantages in mathematics textbooks, classroom teaching situations, and life situations familiar to students. Based on this, how to cultivate students' core mathematical literacy, enhance students' interest in mathematics, and enhance students' confidence in learning mathematics is a problem worth thinking and studying. Enhance their understanding of mathematical concepts. China is a multi-ethnic country, and education is an important part of China. The quality of education will directly affect the success or failure of the modernization of national education [4]. Therefore, it is necessary to strengthen and pay attention to the issue of minority education. At present, mathematics education has entered the bottleneck period of mathematics education development. To solve the problem of mathematics education as the driving force to promote the development of national education, the mathematics culture is integrated into

the mathematics education activities, and the students with the temperament of mathematics culture are cultivated. Attach importance to mathematics learning and promote the cultivation and development of students' core mathematical literacy. In addition, there are many excellent mathematical cultures and resources hidden in minority cultures. In order to better explore and utilize these mathematical cultures and resources, further thinking and exploration are needed. The main contribution of this paper is to offer suggestions for promoting the development of mathematics education for ethnic minorities.

2. Survey plan design

2.1. Research objective

The purpose of this survey is to deeply analyze the actual situation of mathematics education in ethnic minority areas of China, in order to identify bottlenecks and problems, and explore targeted improvement measures and strategies. Through systematic research and data analysis, we can accurately grasp the characteristics of minority mathematics education, such as the allocation of educational resources, adaptability of teaching content, diversity of teaching methods, and educational equity.

Firstly, through investigation, the current situation of mathematics education in ethnic minority areas can be revealed, providing scientific basis for formulating targeted teaching strategies[5]. In response to the identified problems, education policies can be adjusted in a timely manner to optimize the allocation of educational resources and ensure that every minority student can enjoy high-quality mathematics education.

Secondly, surveys help promote educational equity and promote the comprehensive development of students in ethnic minority areas. By improving the current situation of mathematics education, we can enhance the comprehensive quality of students in ethnic minority areas, help them better integrate into mainstream society, and achieve the unity of personal value and social value.

Finally, the investigation of the current situation of mathematics education for ethnic minorities is also a way to improve and supplement China's multicultural education system, which is conducive to enriching and developing the theory of ethnic minority education in China, and laying the foundation for the exchange and cooperation of multicultural education on a global scale.

2.2. Investigation content

In the investigation of the current situation of mathematics education for ethnic minorities, the primary direction is to gain a deeper understanding of the popularity and implementation of mathematics education in various ethnic minority areas, including the construction of hardware facilities for local mathematics education, such as school facilities and teaching equipment[6]; Software resource status, such as teacher resources, textbook applicability, teaching methods, etc; And the position and role of mathematics education in the education system of ethnic minority areas.

The second direction is to explore the differences and influencing factors between minority mathematics education and mainstream education environment, such as the influence of regional cultural characteristics on the acceptance of mathematics education, the constraints of language barriers on the dissemination and practice of mathematics education, and the psychological and cultural adaptation problems faced by minority students when learning mathematics.

The third direction is to study the special needs of mathematics education for ethnic minorities, such as the teaching strategies and service support adopted for different cognitive styles, learning habits, and special education needs of ethnic minority students, and how these special needs affect their mathematics learning process and effectiveness.

2.3. Research method

2.3.1 Literature searching

The literature retrieval method is a research method aimed at quickly and accurately identifying, locating, and obtaining relevant literature from a vast library of literature resources. This method emphasizes the systematic collection, organization, screening, and analysis of various types of literature materials based on the research topic and scope, including books, journal papers, conference papers, patent literature, reports, and other forms of information[7].

The core of literature retrieval method lies in formulating clear literature retrieval strategies, which involve multiple stages such as keyword selection, database determination, retrieval method construction, and setting of limiting conditions. By implementing this strategy, researchers can effectively select literature closely related to their research field and with high academic value or practicality from a vast amount of literature, ensuring that the research foundation is built on comprehensive and reliable information.

The literature retrieval method also requires content analysis of the obtained literature, including but not limited to the analysis of research topic classification research methodology, summary of research conclusions, etc., in order to extract important insights and progress in the field, identify potential research gaps and future research directions.

2.3.2 Group discussions

Group discussion is a qualitative research method that involves organizing small, focused discussion sessions to collect and analyze data. This method usually consists of a group of 6-10 people, guided by one or more hosts, to engage in in-depth and open discussions around pre-set topics or questions.

The main purpose of group discussion method is to stimulate the collective wisdom of group members, explore questions to stimulate deep insights, and promote the exchange and integration of deep insights. It can also reveal implicit themes and viewpoints, providing researchers with a wealth of information that is difficult to obtain quantitatively[8]. The implementation of group discussion usually includes several stages. The first stage is the preparation stage, which requires determining the size of the group, personnel composition (such as experts, stakeholders, users, etc.), discussion topics, and goals. We also need to design and produce guiding discussion outlines and questions to ensure the depth and direction of the discussion. During the implementation phase, the host is responsible for guiding the discussion, ensuring that all participants have the opportunity to speak, encouraging them to share their perspectives and experiences, and delving into key issues. The host also needs to manage the discussion process, maintain order, and ensure that all participants can understand the topic and purpose of the discussion.

2.4. Sampling design

2.4.1 sample method

This survey adopts an anonymous online questionnaire form, so the sample distribution range is wide, involving differences in characteristics such as gender, occupation, education, age group, etc. of the survey subjects. According to statistics, a total of n survey questionnaires were collected, and m invalid questionnaires were excluded. Among them, i valid questionnaires were collected, with an effective rate of $x\%$. Among them, the data is highly reliable and can be used as research basis in accordance with the same level and completeness principles of survey questionnaires. Descriptive statistics on the basic information of the respondents in this survey. Among the $n-m$ respondents, there were r males, accounting for $\%$, and t females, accounting for $\%$. The proportion of males was slightly higher than females.

This article adopts random sampling and strictly adheres to the principle of probability. Due to the sample size being nm , and the sample population being teachers and students in the field of minority education, the number is very large. The sample size is much smaller than the sample population, so pure random sampling is used.

2.4.2 Sample size determination

This article adopts a multistage $n=5$ non strict π PS sampling method for sampling. The determination of sample size is the basis of sampling survey, so the necessary sample size should be determined first.

If the proportion of units with a certain attribute in the estimated population is p , an approximate sample size can be obtained as

$$n_0 = \frac{t^2 Q}{\gamma^2 P} \quad (1)$$

Among them, n_0 is the approximate sample size, γ For the relative allowable error, t is the critical value at a certain confidence level.

Due to our use of complex sampling, the required sample size should be

$$n^1 = n_0 \times Deff \quad (2)$$

we take $p=0.5$, the relative allowable error is not more than 5%, and $Deff=1.5$ to calculate the optimal sample size as $n=Q$. Assuming a sample recovery rate of 80%, we plan to distribute N questionnaires.

2.5. Conduct investigation

2.5.1 Preparation work for investigation

On the basis of all members in the group determining the investigation topic, having a correct understanding of the investigation content, and starting to formulate the investigation plan, make each member more familiar with the nature, purpose, requirements, and methods of the investigation topic. At the same time, further determine the content and purpose of the survey, the survey object, and the scope of the survey to ensure the accuracy of the sample[9].

Provide training on questionnaire surveys to team members, so that everyone is familiar with the questionnaire, masters questionnaire skills, and enhances their sense of responsibility. Conduct a preliminary survey using the designed questionnaire, analyze the results of the preliminary survey.

2.5.2 Division of labor among project team members

According to the purpose and requirements of the investigation, group members systematically learned and mastered some necessary investigation knowledge, techniques, and precautions by consulting guidance teachers and consulting relevant materials, comprehensively improving their investigation abilities and qualities[10]. On this basis, in order to ensure that the investigation work can be carried out efficiently, we have reasonably allocated the work during the investigation process based on the region of the team members and their personal expertise. The specific arrangement is shown in the table 1 below.

Table 1 Task Division Table for Project Team Investigation

task	grouping	head
Investigation stage	minority nationality1	member1
	minority nationality2	member 2
	minority nationality3	member 3
	Deep research	member 4
	Coordinate the investigation process	member 5
Data entry and review stage	Pre investigation	All staff
	formal investigation	
Data analysis and writing report stage	SPSSPRO Data analysis	All staff
	Report integration and writing	

2.5.3 Survey implementation methods and processes

In the formal survey process, we will determine the survey method as a combination of probability sampling and non probability sampling, mainly including multistage sampling, quota sampling, convenience sampling, using probability sampling to determine the sample jurisdiction, and using non probability sampling to determine the respondents.

2.6. Sampling effect testing and control

After the questionnaire is collected, before organizing and inputting data, it is reviewed, that is, the questionnaire is first browsed to ensure the objectivity, accuracy, and completeness of the information. Strictly adhere to the principles of integrity, authenticity, and accuracy.

2.6.1 Integrity principle

Check if the questionnaire is filled out completely. If the data collection is incomplete, especially for core issues, it will reduce or even lose the value of analytical research. Therefore, if incomplete answers are found, it is necessary to conduct follow-up if possible to complete the questionnaire survey. For example, if it is impossible to complete due to limitations and there is a lot of missing information, all the information in the questionnaire must be abandoned instead of further organization.

2.6.2 The Authenticity Principle

Firstly, based on common sense or existing experience, distinguish the answers in the questionnaire to see if they truly and reliably reflect the objective situation of the survey subjects. If the problem is serious, it must be followed up by investigators or others. If further action cannot be taken, it must be deleted.

2.6.3 Accuracy principle

To conduct logical verification of data, this work can be carried out before or after data entry to check for any unreasonable or contradictory aspects in the surveyed data. The questionnaire should be carefully analyzed and then corrected to obtain accurate data. If it is truly uncertain, both can only be treated as missing values.

In this survey, we adopted a multi-stage $n=5$ non strict π PS sampling method. To assess the effectiveness of sampling and control the accuracy of sampling estimation, we measured the effectiveness of sample design and calculated the design effectiveness coefficient $Deff$ for this sampling survey.

By collecting and organizing sample data, we can calculate the total variance and obtain $Deff=1.498$. Therefore, our design based on four stage simple random sampling has a much better effect.

2.6.4 Formal survey data verification

We evaluated the reasonable and effective performance of the survey tool by using three methods: reliability test, validity test, and principal component analysis. Among these three analysis methods, reliability testing (corresponding to "whether the questionnaire is trustworthy"), validity testing (corresponding to "whether the designed questions are reasonable and effective"), and principal component analysis (corresponding to "aggregation of question questions") prove the authenticity and effectiveness of the survey data and tools from three aspects.

Before the formal investigation, data preprocessing is first performed on n valid collected survey questionnaires (m actually distributed) from these samples. If there are any unreasonable aspects in the questionnaire and data, they should be improved in a timely manner to ensure the credibility and strong correlation of the survey.

2.6.5 Reliability Analysis

Using SPSSPRO software to conduct reliability analysis on the survey questionnaire on the current education situation in ethnic minority areas, Cronbach's alpha coefficient table was obtained (as shown below). For Cronbach's α There is currently no unified standard for analyzing co

efficients (or half coefficients), but according to many mathematicians, Cronbach's α . If the coefficient (or half coefficient) is above 0.9, the reliability of the test or scale is excellent. A range of 0.8_0.9 indicates good reliability, 0.7_0.8 indicates acceptable reliability, 0.6_0.7 indicates average reliability, and 0.5_0.6 indicates less than ideal reliability. If it is below 0.5, it is necessary to consider rearranging the questionnaire. The coefficient values shown in the table below indicate that the reliability of this questionnaire is good.

Next, the validity of the survey questionnaire will be tested. Validity testing reflects whether the question design of the survey questionnaire is reasonable and effective. The specific analysis steps for validity testing are, firstly, conduct KMO and Bartlett tests: for the KMO test, 0.9 is very suitable for factor analysis; 0.8 to 0.9 is more suitable; 0.7 to 0.8 is suitable; 0.6 to 0.7 is still acceptable; 0.5 to 0.6 indicates difference; 0.5 should be abandoned. The KMO value test indicates that there is a correlation between the variables of the items, which meets the requirements of factor analysis. For Bartlett's test, if the significance value is less than 0.05, the null hypothesis is rejected, indicating that factor analysis can be performed. If the null hypothesis is not rejected, it indicates that these variables may provide independent information and are not suitable for factor analysis. Analyze the total variance of the explanation and the gravel plot. The total variance of the explanation mainly depends on the contribution rate of factors to the variable explanation (which can be understood as how many factors are needed to express the variable as 100%). Generally, it needs to be expressed above 80%, otherwise the factor data needs to be adjusted. The function of the gravel plot is to confirm the number of factor principal components that need to be selected based on the slope of feature value decrease, and the combination of these two can be used to confirm or adjust the number of factor principal components.

Next is the analysis of the factor loading coefficient table: for common factor variance: each variable can be represented by a common factor, and the size of its expression is the "extraction" in the common factor variance table. The larger the "extraction" value, the better the variable can be expressed by the common factor. Generally, a value greater than 0.5 can be said to be expressed, but it is better to require a value greater than 0.7 to indicate that the variable can be expressed by the common factor reasonably. For factor loading coefficients and heatmaps: Assuming there are three scales: A1 to A3, B1 to B4, C1 to C4, analyze the corresponding relationship between the items and factors of each scale. For example, if there are three factors, the maximum factor loading coefficients of A1 to A3 are all in factor 1, and the maximum factor loading coefficients of B1 to B4 are all in factor 2, and so on, it indicates excellent validity; If the maximum values of factor loading coefficients for A1 and A2 are both in factor 1, and the maximum values of factor loading coefficients for A3 are both in factor 2, it indicates that the corresponding relationship does not match expectations, and there may be design confusion in the item. If the factor loading coefficient (usually 0.4 as the standard) is low, it can be considered to delete the item and conduct validity analysis again. If KMO and Bartlett's tests pass, specific business analysis can also be combined.

2.6.6 Discriminant analysis

Discriminant analysis is the grouping and comparison of data according to quantiles: for variable 3, the Pvalue of significance is 0.000 * * *, which shows significance at the horizontal level and rejects the null hypothesis, indicating that the scale item design has high discrimination and is more reasonable. For variable 5, the significance Pvalue is 0.164, which is not significant at the horizontal level. Accepting the null hypothesis indicates that the discriminability of the scale item design is not significant, and the question may need to be adjusted. For variable 4, the significance Pvalue is 0.006 * * *, indicating significance at the horizontal level. Rejecting the null hypothesis indicates that the scale item design has high discrimination and is more reasonable. Firstly, conducting normality analysis on the scale usually requires the scale to follow a normal distribution. Use Ttest to determine whether the Pvalue is significant ($P < 0.05$). If it is significant, perform a difference analysis based on the mean and test value, describe the size of the difference. If there is a difference, it indicates that the scale item design is appropriate. Otherwise, it indicates that the scale item cannot distinguish information, and if the design is unreasonable, it should be deleted. Summarize the analysis.

3. Conclusions

In order to improve the current situation of education, this article needs to take a series of measures. Firstly, increase the school environment, especially in remote and pastoral areas, to ensure that every child has the opportunity to receive education. Secondly, strengthen the construction of the teaching staff, improve the educational level and teaching methods of teachers, and provide better educational services for students. At the same time, it is necessary to combine traditional culture and lifestyle habits, develop targeted educational content and methods, and improve the pertinence and effectiveness of education. In addition, we also need to strengthen psychological counseling and care for ethnic minority students, helping them establish correct worldviews and values. The summary is as follows: Increase investment in educational resources in ethnic minority areas, improve school facilities and teaching conditions; Develop mathematics textbooks for students and provide teaching resources for their own ethnic languages; Strengthen the training and support of regional teachers to improve their mathematical teaching level; Valuing and respecting cultural traditions, promoting effective implementation of mathematics education through cross-cultural teaching methods; Strengthen communication and cooperation with parents of ethnic minorities, jointly pay attention to the mathematics learning situation of students, and provide necessary support and assistance.

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