A Study on the Optimal Allocation of Science Education Resources in Primary Schools--A Case Study of Fujian Province

Meng Wu

School of Public Finance and Taxation, Dongbei University of Finance and Economics, Dalian, Liaoning, China

wm15330288276@outlook.com

Abstract. Science Education in primary school plays a fundamental role in the science education system and has recently received policy support and widespread social attention. However, there are still differences in the development of primary school science education between urban and rural areas. Taking Fujian Province as an example, this study compares the situation of primary school science education resources, teachers, and educational financial investment between urban and rural areas, and finds that there are uneven distribution of urban and rural education resources, insufficient construction and sharing mechanism of school resources, adequate teachers and professional training, poor integration and standardized management of off campus resources, and uneven distribution of financial funds in Fujian Province. Based on this, this study puts forward the following suggestions: strengthen the training of primary school science education teachers, optimize the allocation of primary school science education resources, promote the reform of primary school science education and teaching, and strengthen the policy support and guarantee of primary school science education.

Keywords: Science education; education resources; resource allocation; education finance.

1. Introduction

Science education is an integral part of Building Morality and cultivating people. Science education in primary school is by no means a simple teaching of knowledge, but a starting point for shaping future social science citizens. Science provides facts about the world through independent observation [1]. Science education teaches students how to understand the world through science, which is about whether individuals can remain competitive in the era of intelligence and whether countries can occupy the commanding heights of the technological revolution. What science education leaves behind is the courage to explore the unknown and the ability to think rationally.

In past reforms, the most important feature of science curriculum development has been the shift from teaching science as a body of knowledge to using scientific experience as a way to generate and verify such knowledge [1]. In 2001, the curriculum reform established the goal of scientific literacy training and advocated experiential learning. In 2017, science education was expanded to grades 1 to 2, and differentiated teaching was implemented in three stages to highlight the practicality of the curriculum. In 2023, the construction of national science education experimental zones and schools was launched, but the regional distribution was unbalanced between urban and rural areas. In 2025, the blueprint of ruheshixiangkexuejiayu1ga was further planned. With the support of sustained policies, science education, as the core carrier of cultivating students' comprehensive quality, is becoming a key area of education reform, and its basic, comprehensive, and practical characteristics deserve in-depth study.

The above policies are unified documents, and there are regional differences in the specific implementation process. Taking Fujian Province as an example, this study finds the problems of existing resource allocation by comparing the situation of primary school science education resources, teachers and financial investment in education between urban and rural areas, and explores how to allocate resources efficiently, combined with the experience of primary school science education in developed countries

2. Importance of Science Education in Primary Schools

2.1. The Role of Science Education in Primary Schools in Social and National Development

Primary school is the golden period of budding scientific interest. Through systematic scientific enlightenment education, individuals with scientific research potential can be selected from children. Research shows that 68 percent of Nobel laureates have shown significant exploration and scientific sensitivity in primary school. This early recognition provides a basic reserve for the construction of the national scientific and technological talent echelon. Primary school science education is the key foundation to enhance the competitiveness of national science and technology and the scientific quality of the whole people, and provides early soil for the country to train innovative talents. By stimulating the scientific interest of teenagers, it will lay the foundation for the reserve of scientific off-campus and technological talents in the future, help to achieve high-level scientific and technological self-reliance and self-improvement, and promote the construction of an innovative country. At the same time, science education strengthens the critical thinking ability of the whole society by disseminating scientific ideas and methods, and promotes scientific and technological progress and sustainable social development.

2.2. Ecological Value to the Science Education System: The Starting Point of Building an Integrated Training Ecology

Science Education in primary schools is an experimental field for interdisciplinary integration. Science and physics, chemistry, geography, and biology are integrated to varying degrees. For example, learning simple machines such as levers and pulleys in the sixth grade of primary school science lays the foundation for learning deeper simple machines in the eighth grade [2]. For example, the "campus ecosphere" project organically integrates biology, geography, mathematics, and other disciplines, which is migrating to other areas of basic education to promote the innovation of teaching paradigm. In addition, science education emphasizes inquiry learning, which provides a time model for deepening curriculum reform and implementing core literacy in the science education system.

2.3. Lifelong Value to Individual Development

There are four elements to any science education: building students' understanding of scientific knowledge and ideas, developing students' awareness of critical reasoning, developing students' ideas about science, developing students' ability to collaborate, and providing engaging and stimulating experiences [3].

The predictability and security that science provides establish a platform to restore attitudes toward the world [4]. Primary school science education lays the foundation for critical thinking and problem solving by fostering curiosity and cultivating scientific inquiry ability. Its practice-oriented teaching methods (such as experimental operation and interdisciplinary projects) not only strengthen the ability to combine hands with brains, but also shape innovative spirit and engineering thinking in the early stage, forming the core competitiveness to adapt to the future society. In addition, the improvement of scientific literacy helps students establish a scientific cognitive framework to provide sustained motivation for lifelong learning and career development.

3. Implementation Issues

Taking Fujian Province as an example, this study finds the problems of existing resource allocation by comparing the situation of primary school science education resources, teachers and financial investment in education between urban and rural areas, and explores how to allocate resources efficiently, combined with the experience of primary school science education in developed countries.

3.1. Uneven Distribution of Educational Resources in Urban and Rural Areas

Weak areas lack resources. By comparing the number of books, multimedia classrooms, and computers in urban and rural areas of Fujian Province from 2025-2020, it is found that the number of computers in urban areas is about four times that in rural areas, even reaching 474949 in 2020, and increasing year by year. The number of computers in rural areas has remained at a very low level, floating around 110000. In terms of books, the number of primary school books in cities is about twice that of rural areas, and has been increasing. In 2020, the number of urban books reached 41763614, compared with 17205390 in villages, but the number of rural maps has been at a low level. The number of online multimedia classrooms in rural and urban areas is increasing, but the number of multimedia classrooms in urban primary schools has been higher than that in rural areas.

Therefore, the high-quality resources of science education are more concentrated in urban areas or key schools, while schools in old revolutionary areas, former Central Soviet areas, and remote and weak counties and districts are still facing problems such as insufficient experimental equipment and curriculum resources. Although the policy proposes that "funds and projects should be inclined to weak schools", there is still a gap between urban and rural areas in actual implementation. Although the policy encourages the integration of social resources such as science and technology museums and university laboratories, it is difficult for rural schools to make effective use of these resources due to their remote geographical location and poor docking mechanism.

3.2. Insufficient Resource Construction and Sharing Mechanism in the School

The utilization rate of rural experimental equipment is low. Although some rural schools are equipped with science laboratories or maker spaces, the phenomenon of idle equipment is prominent due to the limited ability of teachers or the management mechanism. Although the open sharing policy of large-scale scientific research instruments has been introduced, the equipment sharing between primary and secondary schools, universities, and scientific research institutions still lacks a normal cooperation mechanism.

In addition, the development of curriculum resources lags. Homework design of science textbooks in primary schools in China pays more attention to knowledge teaching and lacks guidance in guiding students' thinking ability. Science education characteristic schools require the development of heuristic and inquiry courses, but some schools still rely on traditional textbooks, lack school-based courses deeply integrated with STEM education, and lack independent research and development capabilities.

3.3. Insufficient Teaching Staff and Professional Training

The proportion of full-time science teachers in China is insufficient, the proportion of part-time teachers is too high, and the liberal arts background is the majority. The number of primary school science teachers is the smallest compared with other disciplines, and the proportion of primary school science teachers with a bachelor's degree or above ranks second to last, only 58.23% [5]. At the end of 2021, the science and teaching special committee of the basic education and Teaching Steering Committee of the Ministry of Education launched a nationwide survey covering 131000 primary school science teachers. The survey shows that more than 70% of primary school science teachers specialize in nonscience and engineering, and the proportion of primary school science teachers with a bachelor's degree or above ranks second to last. The undergraduate rate of rural teachers is lower, and the mastery of professional scientific knowledge is less [5]. The second is the lack of professional quality. Rural teachers are significantly weaker than urban teachers in curriculum knowledge, student cognition, and teaching evaluation, and the proportion of students and teachers in rural schools is less than that in urban schools, and the average age of teachers is on the high side [6,7]. Third, there is a lack of development mechanism, outdated lesson preparation mode, lack of innovative training, weak experimental management ability, and insufficient coordination between urban and rural teaching and Research [8,9].

Focusing on primary school science education in Fujian Province, at present, the full-time rate of primary school science teachers in Fujian Province is less than 25%, there are many part-time teachers, and the sense of professional identity is insufficient. More than half of the science teachers have less than five years of teaching experience. The main teaching methods are still teaching methods and experimental teaching methods. Few people pay attention to inquiry and experimental teaching methods, and there is little innovative training. Although the school is equipped with laboratories, there are few professionals, and management will not become a problem [10]. At present, there is still a significant gap between the reserve of teachers and the development needs of science education, and systematic solutions are urgently needed. Tensions are rising in the countryside. Science education requires higher interdisciplinary literacy of teachers, but there are generally some problems in rural schools, such as an insufficient number of science teachers and a single professional background. Although the policy proposes to "train 1000 backbone teachers per year", the coverage is still limited. Generally speaking, the reserve of primary school science teachers is insufficient to meet the needs of the rapid development of science education.

The incentive mechanism for rural teachers is not perfect. Incentive mechanisms such as workload identification and Title Evaluation of science teachers have not been fully implemented, resulting in insufficient enthusiasm for teachers to participate in science education reform.

3.4. Integration and Standardized Management of Off-Campus Resources

The docking of social resources is not smooth. In 2024, the Fujian Provincial Department of education and other 24 departments issued the notice on carrying out the free opening activities of "100 museums and 1000 schools" for Science Education in primary and secondary schools, and decided to jointly carry out the free opening activities of "100 museums and 1000 schools" for Science Education in primary and secondary schools, integrate resources from all parties, highlight collaborative education, promote the organic connection between the main position of schools and the social classroom, and create a new pattern of all-round science education. Although the "100 museums and 1000 Institutes" plan to include science and technology museums and enterprise R&D centers in the resource list, the cooperation between the University and these institutions mostly stays at the visiting level, lacking in-depth project cooperation. Although conditional museums and institutes are encouraged to carry out public welfare science popularization activities in rural schools to send scientific knowledge to rural primary and secondary school students. However, the specific implementation plan is not put forward, and the feasibility remains to be tested.

The supervision of off-campus training is absent. When introducing science and technology after-school training institutions to participate in after-school services, there are risks such as non-standard access mechanisms and disguised business promotion, and some areas have not strictly implemented the "white list" competition requirements.

3.5. Funding Allocation and Sustainability Challenges

There are great differences in local financial support. In 2024, the total amount of subsidies for the construction of science education experimental zones and experimental schools in Fujian Province, projects entrusted by the Department, and research projects was 2.25 million yuan. Quanzhou City, city level, Fuzhou City, and other special fund subsidies are the largest, and in most counties and townships, there is no science education subsidy.

Supporting funds for cities and counties are insufficient, especially in economically underdeveloped areas. For example, some of the science and technology projects in Xiamen need to be self-financed, which may affect the sustainability of resource investment.

Insufficient participation of social capital: the socialized resources of Science Education (such as corporate donations and foundation support) have not yet formed a scale, and excessive dependence on financial allocation has led to insufficient long-term development momentum.

Based on the above research, it is found that there are unbalanced educational resources between urban and rural areas in primary school science education in Fujian Province, an insufficient resource

construction and sharing mechanism in schools, large differences in teachers, integration and standardized management of off-campus resources, and unbalanced financial investment. According to the above problems, policy suggestions are put forward.

4. Policy Recommendations

4.1. Strengthen the Training of Primary School Science Education Teachers

First of all, relying on the "National Excellence plan" is used to select and train primary school science teachers. Using the selection mechanism of the "National Excellence plan", talents interested in science education in primary schools are selected from outstanding science and engineering graduates or graduate students. Through systematic teacher education module courses and practical training, primary school science teachers with deep scientific literacy, educational feelings, and excellent teaching ability are trained.

Secondly, the state needs to explore the joint training mode of "universities+primary and secondary schools". And support high-level comprehensive universities to set up primary school science education majors or related courses, and use their superior resources in science and engineering, and pedagogy to train interdisciplinary primary school science education talents. Colleges and universities are encouraged to establish close cooperative relations with primary and secondary schools, further improve the common teaching and research platform, and jointly carry out practical research and teaching reform of science education in primary schools.

4.2. Optimize the Allocation of Science Education Resources in Primary Schools

The government needs to invest more to improve science education in primary schools. The government should increase financial investment in science education in primary schools, improve teaching facilities and equipment conditions in schools, and provide a good teaching environment for teachers and students. Enterprises and social organizations are encouraged to participate in the support and donation of primary school science education and jointly promote the development of primary school science education.

High-quality educational resources need to be integrated to promote balanced development. Integrate high-quality resources for primary school science education nationwide, including excellent teachers, courses, and textbooks.

The government should promote the balanced development of science education in urban and rural primary schools, narrow the gap between urban and rural education, and let more rural students enjoy high-quality science education resources in primary schools.

4.3. Promote the Reform of Science Education and Teaching in Primary Schools

Teaching methods need to be innovated, and teaching quality needs to be improved. Encourage primary school science teachers to adopt diversified teaching methods and means, such as inquiry learning and project learning, to stimulate students' interest in learning and innovation ability. Attach importance to the STEM education model.

The construction of science education curriculum and teaching materials in primary schools should be strengthened. Organize expert teams to research and develop primary school science education curriculum and textbooks to ensure that they meet the requirements of the times and students' needs, and attach importance to the STEM textbook development mode.

Social resources management should be standardized. Formulate guidelines for off-campus resource cooperation, clarify the access standards for scientific and technological training institutions, and avoid commercialization. Deepen in-depth cooperation with universities and promote the vigorous development of science education.

Attention should be paid to science education in primary schools, and policy guarantees should be provided.

5. Conclusion

Taking Fujian Province as an example, this study finds the problems of existing resource allocation by comparing the situation of primary school science education resources, teachers and financial investment in education between urban and rural areas, and explores how to allocate resources efficiently, combined with the experience of primary school science education in developed countries. It is found that there is are uneven distribution of educational resources in urban and rural areas, insufficient construction and sharing mechanisms of resources in schools, insufficient teachers and professional training, poor integration and standardized management of resources outside schools, and uneven distribution of financial funds in Fujian Province. Based on this, this study puts forward the following suggestions: strengthen the training of primary school science education teachers, optimize the allocation of primary school science education resources, promote the reform of primary school science education and teaching, and strengthen the policy support and guarantee of primary school science education.

References

[1] Hodson D. Philosophy of science, science and science education. 1985.

[2] Cheng J. Light of scientific enlightenment: the importance of science education in primary schools. Friends of Science, 2025, (01): 132-133

[3] Osborne J. Science education for the twenty-first century. Eurasia Journal of Mathematics, Science and Technology Education, 2007, 3(3): 173-184.

[4] Alsop S, Watts M. Science education and affect. International Journal of Science Education, 2003, 25(9): 1043-1047.

[5] Zheng Y, Yang X, Wang J, et al. Current situation, impact, and suggestions of science teachers in primary schools in China: a large-scale survey based on 31 provinces. Journal of East China Normal University (Educational Science Edition), 2023, 41 (04): 1-21.

[6] Cui F. Comparative study on discipline teaching knowledge (PCK) of urban and rural primary school science teachers. Liaocheng University, 2018.

[7] Lyu X. Research on the problems and Countermeasures of science curriculum resources in urban and rural primary schools from the perspective of balanced development. Bohai University, 2020.

[8] Lan Q. Exploration on online teaching and research mode of urban and rural coordination from the perspective of educational equity - taking science teaching and research in primary schools in Kaiping City, Guangdong Province as an example. Digital Teaching in Primary and Secondary Schools, 2024, (07): 81-84.

[9] Cao K, Fan X. An investigation and Study on the current situation of science teaching in urban and rural primary schools - A case study of Beibei District, Chongqing. Science, Education and Culture Collection (Next Ten Days), 2019, (18): 132-133.

[10] Li Q, Chen L, Cai H. Investigation, analysis, and Path Exploration of the construction of science teachers in primary schools in Fujian Province. Journal of Fujian Institute of Education, 2024, 25(06): 14-16.