

Existing Problems and Development Countermeasures of Biology Teaching in Rural Middle Schools

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Abstract

At present, with the rapid development of biology, the national basic education also pays more and more attention to the biology curriculum, updates the educational concept, and implements the curriculum reform, which has significantly improved the quality of biology teaching in middle school. However, due to the uneven distribution of educational resources between urban and rural areas, there is still a big gap in biology teaching between rural and urban areas. This paper mainly analyzes the main problems of biology teaching in rural middle schools through literature research and combined with the current teaching situation of several rural middle schools in Henan Province. The results show that the problems existing in biology teaching in rural middle schools mainly focus on three aspects: teachers, biology experiment teaching, and the development and utilization of biology curriculum resources. This paper aims to investigate and study the main problems existing in biology teaching in rural middle schools, and then put forward targeted development countermeasures to improve the quality of biology teaching in rural middle schools and narrow the teaching gap between urban and rural areas. Such as strengthening the construction of biology teachers and promoting teachers' professional development, changing the concept of biological experiments, and strengthening the construction of laboratories, on the basis of making full use of school resources, vigorously developing natural resources, and network resources. The number of rural middle schools in China is huge and the teaching situation is complex. Therefore, this study is not comprehensive. It is the problem of most rural schools, not all schools. Rural education is the weak point of Chinese education, and biology teaching is the weak point of rural education. Analyzing the existing main problems of biology teaching in rural middle schools and putting forward development countermeasures can not only enrich the theoretical research of rural education, but also provide reference for the teaching practice of rural teachers.

Keywords: Biology teaching; Teacher professional development; Biology experiment teaching; Curriculum resources; Development countermeasures.

1. Introduction

The 21st century is called the biological century. Biology has penetrated into many fields of social development. Many problems faced by human social development are closely related to biology, such as agricultural development, environmental pollution, human diseases, medical technology and food safety. China's senior high school biology curriculum standard mentions that learning biology curriculum is an indispensable educational experience for every citizen and its learning results are the basic component of civic literacy. From the perspective of entering a higher

school, biology in junior middle school and biology in senior high school have been included in the high school entrance examination and college entrance examination respectively. The importance of biology is self-evident. Compared with cities, biology teaching in rural middle schools is in a weak position, and school leaders, teachers, students and students' parents do not pay enough attention to biology, and biology teaching also has many problems. This paper combs the existing problems of biology teaching in rural middle schools, and puts forward the corresponding countermeasures to improve the quality of biology teaching in rural middle schools.

2. Main Problems in Biology Teaching in Rural Middle Schools

2.1. The Number of Biology Teachers is Insufficient and Teachers' Professional Development is Limited

The effectiveness of rural middle school education is directly related to the development of China's education and rural social economy. The quality of rural middle school education depends on the quality and level of rural middle school teachers to a certain extent (Tao, 2013). At present, the problems existing in rural education are largely related to teachers, especially in some subjects that are not valued, such as biology. The weakness of teachers is the biggest bottleneck restricting its development.

At present, the contradiction of teacher construction in rural schools has changed from simple quantitative shortage to structural shortage, and has become a new factor restricting the development of rural education (Zhou *et al.*, 2018). Structural shortage refers to the shortage of teachers when the total number of teachers reaches or exceeds the specified quota, but the actual quota of primary and secondary schools is insufficient or the quantity can't meet the teaching needs. This structural contradiction is mainly reflected in Teachers' subject structure, age structure, educational background structure and professional title structure, reflecting the new unfair education. From the perspective of discipline structure, rural schools can only use limited staffing to recruit teachers with a large number of discipline hours, resulting in the imbalance of discipline ratio (Liu *et al.*, 2019). Taking biology teachers in rural middle schools as an example, the number of class hours of biology is small, so the number of teachers recruited is small, resulting in the shortage of biology teachers, and the shortage of full-time and professional biology teachers (Shi, 2020). Biology has become a marginal subject or sideline subject because its test score is relatively small compared with other subjects, which is not valued by everyone (Taking Henan Province as an example, biology in the middle school entrance examination accounts for 50 points and biology in the college entrance examination accounts for 90 points). Most rural schools do not have full-time biology teachers, and most of teachers also teach other subjects. There are also many biology teachers who are not biology majors or even non science majors. In the current environment, "what teachers teach is not what teachers learn" means giving up the quality of education, and it also indicates the loss of space and opportunities for teachers' professional development (Miao and Zong, 2017). However, these phenomena are most common in rural junior middle schools.

The new curriculum advocates changing the current situation that the implementation of the curriculum places too much emphasis on passive learning, rote learning and mechanical training (Ministry of Education, 2001), establishes the dominant position of students, and changes the passive indoctrination teaching into active inquiry learning (Xiang, 2019). However, rural biology teachers have a vague understanding of the curriculum concept and still adopt the traditional teaching method. Teachers are the main body and students learn passively (Jia, 2017), which leads to students' low initiative in learning, and their ability to find, analyze and solve problems cannot be improved.

Teachers' professional development refers to the continuous development process in which teachers continuously improve their professional level and gradually move towards professional maturity through professional training and their own active learning and research in the whole process of pre service, entry and on-the-job (Liu, 2011). Teachers' professional development is not only to obtain a professional qualification or professional status, but also to further develop and improve their own level. It is a dynamic and continuous process (Wei, 2018). Teachers' professional development is the fundamental guarantee of education quality, the source of power for the connotation development of schools, and the key to the sustainable development of schools. Promoting teachers' professional development is one of the important tasks of teachers' education reform (Wang, 2019). The professional development of rural teachers is an important guarantee to improve the quality of rural education and education targeted poverty alleviation. At present (Fu *et al.*, 2020), there are still many problems in the professional development of rural teachers.

At present, the main problems faced by the professional development of rural biology teachers are the lack of internal power and the lack of external power. The lack of internal motivation is mainly manifested in the lack of subjectivity, purpose and dynamics of biological teachers' professional development, the passivity and formalization of professional development, the lack of attention to their own professional development and the lack of conscious creation of favorable conditions (Li and Chen, 2021). The main reasons are that some teachers only take the teacher profession as a means of making a living and lack professionalism and professional responsibility. The content of biology in middle school is relatively simple, and biology is in a "marginal position", which will make biology teachers reduce their self-requirements and lack the ability and motivation of professional development. The structure of teachers in rural schools is unreasonable. Some teachers with low educational background and older age will be content with the current situation, have a weak sense of competition and do not seek opportunities for self-development.

The lack of external impetus for the professional development of rural biology teachers is mainly related to the complex rural education environment, low salary, and lack of pertinence in training, heavy teaching and

management tasks of teachers and so on. The educational environment of rural schools is complex, the school infrastructure is imperfect, the laboratory construction is insufficient, and the excellent teachers and students are lost. The family education of students is lacking. Most of them are left behind children, who are taken care of by their grandparents. Rural community education is immature, local culture is gradually lost, students have low self-esteem of local culture and lack of identity with rural schools. The complex trend of educational environment reduces teachers' sense of educational efficacy. Salary is an important restrictive factor that restricts the professional development of rural teachers. The welfare treatment of rural teachers is low, and people generally measure a person's value by the salary level (Xi, 2018), which makes rural teachers have low social status, lack of sense of identity and security, and lose the driving force of development due to their weak sense of self value. When rural teachers are placed in the overall situation of rural education, they are bound to face educational problems with unique circumstances (Gong, 2019). However, today's teacher training mode is urban centered, which does not connect with the specific problem situations of rural schools, and the professional training is lack of pertinence and effectiveness. In addition, the coverage of teacher training is not wide, and the trainers are good at students' teaching rather than teachers' teaching, which makes some rural teachers lose professional self-esteem due to their maladjustment to the new curriculum reform and teacher training mode. Professional self-esteem is the internal dynamic mechanism of teachers' professional development. Teachers' professional self-esteem is reflected in Teachers' professional autonomy, professional self-confidence, professional ideal and professional innovation. The loss of professional self-esteem will lose the internal power of self-development. In addition to teachers, rural teachers also have multiple identities (class teacher, life teacher, counselor, logistics administrator, psychologist, etc.). Heavy teaching and management tasks aggravate teachers' job burnout (Fu *et al.*, 2020). The survey found that 32% of rural teachers have to undertake 3-4 teaching tasks, and 28.9% of rural teachers have to undertake more than 4 teaching tasks (Zhang, 2015), which also makes rural teachers have no extra time and energy to improve and develop themselves. In addition, the limited educational funds, the maladjustment of relevant service system and the imperfect system all restrict the professional development of rural teachers.

2.2. The Experimental Teaching Conditions Need to be Improved, and the Biological Experiment Cannot be Carried Out Effectively

Biology is a natural science based on experiments. The establishment and development of biology take experiment as the exploration tool. The development of biology must take experiment as the driving force. Experiment plays a very important role in biology. Biological experiment refers to the practical activity of actively controlling and intervening the research object or controlling the environment and conditions by using certain means (instruments, equipment, drugs, etc.) according to the research purpose, that is, creating a typical environment or special environmental conditions, and exploring the life phenomenon and its movement law (Peng, 1990). Rural middle schools should strengthen the biological experiment curriculum, which is not only the development requirements of the times and the requirements of the new curriculum reform, but also determined by the nature of the biological curriculum itself. The experimental course can also improve rural students' interest in biology and improve their practical ability. At the same time, it can also cultivate applied talents suitable for local economic development for rural areas.

One of the biggest problems in biology teaching in rural middle schools is experimental teaching. There are two mountains that hinder the effective development of biology experiment teaching in rural middle schools. One is the national college entrance examination. Although the country advocates quality education and all-round development, most schools still focus on achievement. Students' test scores are the most important basis for teachers to evaluate students and schools to evaluate teachers. And the fairest and simplest way for rural students to get out of the countryside is to take the college entrance examination. Therefore, in order to improve performance and pursue "efficiency", the biological experiment in rural schools generally adopts the teaching method of cramming. Experiments are mostly based on Teachers' demonstration and explanation, emphasizing theory rather than practice. The other is the existing unavoidable factors, such as class hours, software and hardware facilities and teachers' experimental level and so on. Biology class hours are generally arranged less, and the time available for experimental operation is even less. In addition, experimental classes generally take a long time and it is difficult to control students' experimental process and experimental results. Therefore, teachers generally adopt the practice of teaching experiments in class and reciting experiments after class. The education funds of rural schools are limited, and the experimental facilities are not fully equipped or damaged. Some school facilities are fully equipped, but only to act as a "Facade", and some experimental reagents and experimental materials cannot be updated in time (Jiang, 2019). The incorrect professional background of biology teachers leads to the low level of experiment (Zhang *et al.*, 2018), the insufficient number of teachers, and the lack of special management in the laboratory. All these hinder the effective development of biological experiments.

2.3. Biology Curriculum Resources are Limited and Need to Be Further Developed and Utilized

The development and utilization of curriculum resources is to find all resources that can be connected with education and teaching activities through census, screening and other means, and make them enter the curriculum or directly serve the curriculum through processing and construction (Fan, 2002). Biology curriculum resources not only affect teachers' teaching process and teaching methods, but also affect students' learning process and learning methods (Bao, 2019). It is an important factor to determine whether the curriculum implementation and curriculum

objectives can be effectively achieved. Actively developing and utilizing biology curriculum resources and giving better play to the advantages of biology curriculum resources in this region is an important way to deepen biology curriculum reform and improve the efficiency of biology teaching. The effective and reasonable development and utilization of curriculum resources can meet the regionalism, nationality, localization and difference of students' development, so as to promote the development of students.

The resources of biological education in rural schools are limited. As an important curriculum resource, the content of teaching materials has time and regional limitations, so it is impossible to cover all aspects. Therefore, in combination with the actual situation of local teaching and students, developing curriculum resources, such as natural resources, information resources and social resources, appropriately enriching the teaching content is conducive to realizing the new curriculum concept, making the curriculum contemporary, ensuring the synchronization between the teaching content and the development of disciplines, ensuring the connection between the teaching content and the life around us, and connecting with the real society, making the educational content have realistic influence.

For biology teaching, the countryside has unique advantages. Rich natural resources provide materials for biology teaching. The utilization of local biology curriculum resources can stimulate students' learning interest and cultivate students' local emotion to a certain extent (Kuang, 2017). At the same time, it can also meet the requirements of students' development, promote teachers' professional development, supplement teaching materials and improve teaching quality.

Today is an era of knowledge economy characterized by informatization. Information technology has a revolutionary impact on the development of education. The combination of information technology and educational activities is the only way of educational reform. The Internet plays an irreplaceable role in primary and secondary education because of its characteristics of "high efficiency, fast and convenient spread". Internet plus education brings new opportunities for Education. First, it breaks through the walls of traditional schools, promotes the realization of ubiquitous learning, breaks through the physical space-time constraints, and eliminates the information gap and regional gap. Second, it takes learners as the center, improves teaching efficiency and quality, enriches teaching content and promotes students' all-round development. Third, it breaks the regional blockade of high-quality educational resources and optimizes the allocation of educational resources. The Internet can eliminate the gap in educational resources caused by regions, schools and teachers, promote educational equity to a certain extent, and promote children in rural areas to realize the mobility of social strata through education (Feng and Yang, 2017). There are many high-quality biological education resources on the Internet, which can make up for the shortage of rural biological education resources to a great extent. At the same time, it can also enable students to understand the frontier progress of biology and keep up with the pace of the times.

At present, the problems existing in the development and utilization of biology curriculum resources in rural middle schools mainly include the following aspects. First, the shortage of biology teachers in rural schools, the low professional counterpart rate of biology teachers and the weak awareness of curriculum resources lead to the buried of a large number of curriculum resources, which cannot be processed, transformed and entered the actual primary and secondary school curriculum in time, resulting in the idleness and waste of many valuable curriculum resources. Second, the experimental ability of most teachers is general or relatively weak, the level of planning and design ability is low, and the implementation ability is poor (Sun, 2018). Third, the support of students, teacher-student relationship, parents and society is also an important and special curriculum resource. But parents of rural students often go out to work. Due to the heavy teaching tasks and non-teaching tasks, it is difficult for teachers to have free time. The rural economy is underdeveloped and the social support available is limited. Fourth, the introduction of the evaluation system assorting with the new curriculum reform is too backward. The examination pays attention to written examination but not practical operation, and the theory is divorced from practice. Fifth, the educational content, objectives and organizational management system of rural schools are relatively unified compared with those of cities, resulting in the school teachers becoming the obedient and dependent of the centralized management system, with little independent initiative and power in education and teaching activities (Guo, 2019). In this case, teachers take teaching materials as the only curriculum resources and lose the enthusiasm to develop other curriculum resources.

The difficulties faced by the development of information resources are as follows. First, the provision of information technology is seriously formalized. Some schools are equipped with facilities to act as a façade. Second, teachers' information literacy is low and their ability to integrate multi-dimensional educational resources is insufficient. Teachers are the key to the effective utilization of information technology equipment. The lack of information-based teaching ability is the main obstacle restricting rural teachers from using information technology in teaching. Although network education resources are rich, they are fragmented and various, with good and bad intermingled. These resources can be used only after teachers are screened and integrated, which is also a big challenge for biology teachers. Third, the function of information technology in rural classroom teaching has been narrowed. In the rural biology classroom, the Internet is only used by teachers to make courseware, which narrows the function of information technology and does not give full play to the practical value of information technology in classroom teaching.

3. Development Countermeasures

3.1. Education Departments and Schools Should Supplement Professional Biology Teachers from Multiple Channels and Promote Teachers' Professional Development from Multiple Aspects

Teachers are the participants, implementers and promoters of curriculum reform. The development and construction of teachers' team is the most powerful guarantee to improve teaching quality. Therefore, the premise of improving the quality of biology teaching is to start with teachers. Schools, teachers and students should pay more attention to the biology subject, and should not judge the importance of a subject only through the test score. Biology should be equipped with professional teachers, and a teacher should not undertake too many classes. When teaching, teachers should adopt changeable teaching methods and pay attention to the guidance of learning methods, so as to improve the quality of students' learning. The local government and rural schools should broaden the recruitment channels. Rural schools can jointly train professional biology teachers with local colleges and universities, improve the teacher rotation system, and regularly exchange and two-way flow of urban and rural teachers. The government and education departments should increase the investment in education funds, improve the salary of rural teachers, meet the basic living and teaching needs of teachers, and attract more excellent talents to throw themselves into rural education. The education department should solve the problem of teacher staffing. Non-teaching personnel such as logistics support can solve it by purchasing social services without occupying the teacher staffing, and establish a provincial overall planning, hierarchical management and special teacher staffing management mechanism (Wu and Chen, 2018). Local governments adhere to the principle of "total control and dynamic management of teacher staffing". A dynamic allocation mechanism is a necessary way to maintain the balance between supply and demand. A certain proportion of reserved staffing should be set up within the total staffing. At the same time, a system of inter school mobility and multi school sharing should be established to improve the efficiency of teacher staffing.

Strengthening teachers' professional development requires efforts from many aspects. Biology teachers' own consciousness and teaching concept directly control their own growth and professional development (Li X. J., 2021). Only by relying on internal self-motivation and self-evaluation can teachers participate in professional learning and improvement, can they achieve the highest level of self-professional development and meet the final requirements (Wei, 2018). Therefore, it is necessary to strengthen the subject consciousness of biology teachers' professional development and strengthen their faith in professional development at the level of consciousness. At the same time, it is important to build a social system of rural teachers' professional development from an all-round and multi-level perspective. At the government level, the state should improve the social support system for the professional development of rural teachers, provide corresponding policy support, increase financial investment, implement the wage treatment mechanism of "differential compensation", and realize the fairness and justice of distribution. The state should also establish relevant training systems, reform the current urban oriented teacher training mode, create diversified and targeted training mechanisms according to the characteristics of rural teachers, and ensure the suitability of training topics, training contents and training forms. At the social level, the society should create a loose, fair and appropriate public opinion environment, improve the public's cognitive level of rural biology teachers, and create a public atmosphere of trust and support. At the school level, schools should provide teachers with opportunities and time for professional development, minimize teachers' non-teaching tasks, and provide financial support for teacher professional development so that training experts can get down and teachers can get out of training. Schools can also promote and implement school-based training, focusing on the needs of schools and teaching policies to improve teachers' professional level and educational and teaching ability.

3.2. It is Necessary to Reverse the Tendency of Ignoring Experimental Teaching and Strengthen the Construction of Biological Laboratory

In rural schools, if biological experiments want to be carried out effectively, first of all, it is necessary to effectively reverse the tendency of school leaders, teachers and students to ignore experimental teaching. School leaders should pay more attention to biological experiments and arrange class hours for biological experiments as much as possible. Teachers should also change the wrong educational thought of "what to test and what to teach". They should not just take the examination results as the standard to measure everything, but should cultivate students with a long-term vision. At the same time, they should change the experimental teaching methods, let students really practice, and make good use of the wrong resources in the experiment to guide students to obtain a successful experience (Li, 2018). Teachers should make full use of modern teaching means to improve experimental efficiency and interest through the effective combination of experimental teaching and information technology. For example, some experiments that are difficult for schools to meet can be displayed through the multimedia platform, and appropriately "slow down" or "pause" to let students have a more intuitive understanding of the experiment (Zhang, 2017). When explaining the experiment, teachers should also carry out laboratory safety education for students. If conditions permit, the school can open the biology laboratory for students to practice.

Local governments and schools should ensure the investment of experimental teaching funds, strengthen the construction and management of biological laboratories, improve experimental teaching facilities, allocate full-time professionals to manage the laboratory, timely supplement instruments, equipment, materials and appliances, and regularly check and repair experimental equipment to ensure that biological experiments can be carried out normally. Schools should also improve the experimental teaching evaluation mechanism, assess teachers from many aspects, and take teachers' experimental teaching ability, teaching level and teaching performance as an important basis for the evaluation and employment of biological teachers' professional titles and performance awards (Ministry of

Education, 2019). Teachers are encouraged to combine the reality of the school and students, draw local materials, set up biology experiments in a simple way, innovate boldly, and design students' experiments with characteristics and creativity (Ministry of Education, 2020). Experimental operation training should be added to teacher training, which should not only improve teachers' experimental teaching ability, but also improve teachers' experimental quality.

3.3. Teachers Should Improve the Awareness and Ability of Curriculum Resource Development, Schools and Education Departments Should Provide Financial Support and Improve the System Guarantee

The development and utilization of biology curriculum resources from nature and the Internet is a complex process, which should not only meet the needs of students and the expectations of parents, but also achieve educational objectives and achieve good teaching results. Teachers' awareness and ability of curriculum resources development determine the identification scope, development and utilization degree and benefit level of curriculum resources. Teachers play a vital role in the development and utilization of curriculum resources. First of all, teachers should improve the awareness of curriculum resource development. In addition to reading relevant books and documents, they should also go out for training and further study. Secondly, teachers should establish the concept of lifelong learning. Only through various ways, teachers can constantly update their ideas, enrich their knowledge reserves, improve their ability structure and strengthen practical training, can they develop effective curriculum resources. Biology teachers should learn new educational concepts and biological professional knowledge. In addition, they should consolidate the foundation of mathematics, physics and chemistry, understand local culture, folk customs and so on, and strengthen the ability of interdisciplinary knowledge. Teachers should also pay attention to the cultivation of information technology ability and experimental ability, develop and utilize information resources, and require teachers to have the most basic courseware making ability and network application ability. Biology is based on experiment. Teachers should have basic experimental ability to innovate experiments and make use of the developed curriculum resources. Finally, teachers should pay attention to multi-party cooperation with colleagues, students, parents, society and other human resources.

For schools, the development of curriculum resources needs certain developers, financial support and institutional guarantee. Therefore, schools should set up curriculum resource development teams, set up special funds for curriculum resource development and improve the curriculum resource development system (Sun, 2018). Schools and education departments can establish curriculum resource database and curriculum resource sharing mechanism. These curriculum resources can be shared among schools to improve resource utilization. The real sharing of curriculum resources must also establish the corresponding experience exchange and cooperative discussion mechanism, and carry out teaching experience exchange and school running thought discussion on a regular and irregular basis. At the same time, it is feasible to build an incentive mechanism for resource development. For example, in the activities of evaluation, award, evaluation and professional title promotion, the development of curriculum resources is regarded as a more important achievement index, so as to arouse the attention of schools and teachers to the development of curriculum resources and promote the full and rational development of curriculum resources.

4. Epilogue

With the development of biological science and technology, basic biology education has received unprecedented attention, but with the deepening of reform measures, the gap between urban and rural school biology teaching is also increasing. There are many problems in biology teaching in rural middle schools. The number of biology teachers is insufficient, the professional counterpart rate is low, teachers have a vague understanding of educational ideas, the traditional teaching method is single, the internal driving force of teachers' professional development is insufficient and lack of external support. It is not a high degree of attention to biological experiments. The experimental time, experimental funds, experimental instruments, experimental materials and drugs, experimental instructors and so on cannot meet the needs of students' experiment and practical teaching activities. The curriculum resources in the school are limited, while the awareness of teachers to develop other curriculum resources is weak, or it is difficult to carry out due to external conditions. In order to solve these problems and improve the quality of biology teaching in rural middle schools, local governments and rural schools need to broaden recruitment channels, supplement professional biology teachers, reform teacher training and strengthen teachers' professional development. They should also change the concept of experiment, increase the investment of experiment funds and strengthen the construction of laboratory. Schools and education departments should provide support and help for teachers' professional development in curriculum development and design, implementation and improvement through various forms. In addition to teachers, biological experiments and the development and utilization of curriculum resources, there are still some other problems in biology teaching in rural middle schools. To solve these problems is inseparable from the joint efforts of society, schools and families. It is certain that with the efforts of all parties, the quality of biology teaching in rural middle schools will be qualitatively improved.

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