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A Survey Study on the Current Status of Professionalism of Elementary School Science Teachers in Changsha County

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Abstract: As the main participants in the teaching of science curriculum, the professionalism of elementary school science teachers is very important to the teaching work of teachers, the scientific literacy of students as well as the reform and development of science education. Therefore, the professional literacy of elementary school science teachers in Changsha County was thoroughly researched and analyzed from three aspects: professional affective literacy, professional knowledge literacy and professional ability literacy. Through the questionnaire survey and interviews, it was found that some science teachers have the problems of lack of professional affective literacy, single knowledge structure and low professional ability literacy. These problems are mainly attributed to the teachers' weak sense of professional development, the limitations of curriculum teaching and implementation ability, the schools' insufficient attention to the science curriculum, and the insufficient investment in education funding. To address these problems, this paper proposes optimization paths such as clarifying development goals, strengthening practice reflection, deepening the learning and application of the new curriculum standards, raising the importance of science curriculum teaching, and increasing the investment in science education. Through these measures, we aim to enhance the professionalism of elementary school science teachers, improve the quality of teaching, cultivate students' scientific literacy, and promote the sustainable development of science education.

Keywords: Elementary science teachers; Professional affective literacy; Professional knowledge literacy; Professional competence literacy

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1. Introduction

In recent years, science education in elementary school has been highly valued in China. With the recommendation of the "double-decrease" policy in education, the State emphasizes the importance of adding science education, aiming to stimulate the curiosity, imagination and desire for exploration of young people, to cultivate a group of young people who have the potential of scientists and are willing to devote themselves

to the cause of scientific research. The "Opinions on Further Strengthening the Popularization of Science and Technology in the New Era," jointly issued by the General Office of the Central Committee of the Communist Party of China (CPC) and the General Office of the State Council, explicitly states that schools need to strengthen science education and continue to improve the scientific quality of teachers and students. The "Plan for Strong Teachers in Basic Education in the New Era," jointly issued by the Ministry of Education and eight other departments, focuses on promoting the revitalization and development of teacher education. Elementary science education is at the forefront of basic science education, and investing in elementary science education is investing in the future. Primary education is the budding period for cultivating elementary school students' scientific literacy, and elementary school science education also has a significant impact on the cultivation of elementary school students' scientific literacy. In addition, science education is a very important strategic policy of education in China, and science education is the most basic way to carry out this strategy, however, the development of science curriculum has not taken the path of specialization [1].

The key to the success of science curriculum reform lies in the teachers. To cultivate students with strong scientific interest and curiosity, good scientific literacy, scientific method and creativity, it is necessary to rely on science teachers with a high level of professionalism. With the deepening of the science curriculum reform, elementary school science teachers have become the main force of the reform, which puts higher demands on them [2]. Therefore, it is of great significance to investigate the current situation of elementary school science teachers' professional literacy, analyze the existing problems, and put forward corresponding suggestions for improvement in order to strengthen the importance of science teachers' teaching concepts and professional literacy, as well as to improve the quality of teaching.

Regarding the composition of teachers' professional literacy, domestic and foreign researchers have their own opinions. Kratz (1896), through questionnaire analysis, explained teacher professional literacy as a collection of knowledge, abilities and beliefs that teachers bring to the teaching situation [3]. Hargreaves A *et al.* (1992), on the other hand, pointed out that the development of teachers' professional literacy includes several dimensions such as technical and ethical, political, and emotional [4]. Foreign studies focus on the factors affecting the development of teachers' professional literacy, which are mainly categorized into personal factors, situational factors and systemic processes. Domestic researchers also have a variety of views on the composition of teachers' professional literacy, such as the three-pointed approach [5–7], the four-pointed approach [8,9], and the five-pointed approach [10]. Although the classification methods are different, they all cover the two core elements of professionalism and professional skills.

This paper intends to analyze the structure of elementary science teachers' professional literacy based on the division basis of the Elementary Teachers' Professional Standards (Trial) in terms of the three aspects of professional affective literacy, professional knowledge literacy, and professional competence literacy [11]. Through questionnaire survey and interview method, the professional literacy status of elementary school science teachers in Changsha County was investigated in order to find out the problems, analyze the reasons, and put forward suggestions for improvement.

2. Research and analysis on professionalism of elementary school science teachers in Changsha County

2.1. Basic situation research

This study focuses on the current situation of elementary school science teachers in Changsha County, which

is located in central China and whose economic, cultural, and educational conditions are representative of the region. An in-depth study of elementary school science teachers in Changsha County provides a glimpse of the general face of elementary school science education in central China. A total of 93 valid questionnaires were collected and analyzed in this research, and SPSS 20.0 software was used to test the reliability and validity of the questionnaires, which showed that the reliability coefficient of the questionnaires was 0.957 and the KMO value was 0.935, thus ensuring the reliability and validity of the research.

The results of the study showed that the elementary school science teaching force in Changsha County showed a significant imbalance in gender distribution, with male teachers accounting for only 25.8% and female teachers as high as 74.2%, highlighting the imbalance in gender distribution within the field of elementary school science education. In terms of age structure, there is a clear trend of rejuvenation in the teaching force, with 46.2% of teachers under the age of 30 and only 22.6% of teachers over the age of 45, indicating that the new generation of teachers dominates the field of primary science education.

In terms of the distribution of duties, only 43% of the teachers were full-time science teachers, while as many as 57% of the teachers had other duties, which posed a challenge to the teaching input and quality of the science curriculum. In terms of the distribution of teaching experience, teachers with 7 to 26 years of teaching experience accounted for half of the total number of teachers, who had accumulated a wealth of teaching practice. Teachers with a shorter teaching experience of 4 to 6 years together accounted for 49.5% of the total number of teachers, and there was still much room for this group of teachers to improve in terms of experience and skills. In terms of educational background, teachers with a bachelor's degree or above accounted for 61.3%, and teachers with a science major and science education background accounted for 64.5% of the total, which was in line with the demand for new professionals in the basic education curriculum reform.

Regarding teachers' titles, 26.9% of teachers had not yet obtained a title, with the highest proportion of teachers with Grade 3 (34.4%) and 38.7% of teachers with Grade 2 or above titles, indicating that the backbone needs to be strengthened. With regard to teacher training, 59.1% of teachers believe that training helps to improve professionalism, and 38.20% believe that it updates scientific knowledge, reflecting a positive attitude to learning and a sense of self-development among the teaching force.

2.2. Exploring the professionalism of elementary school science teachers

Elementary science education plays a key role in cultivating students' scientific literacy, while teachers' professionalism is a decisive factor in teaching quality. This paper analyzes in depth the science professional affective literacy, science professional knowledge literacy and science professional ability literacy of elementary school science teachers in Changsha County.

2.2.1. Science professional affective literacy: the inner driving force of teaching

Science teachers' professional affective literacy, i.e., their deep emotional experience and value recognition in teaching practice, is the inner force that drives teaching enthusiasm and improves teaching quality. According to the survey, 82.8% of teachers have a strong desire to become excellent teachers, 57% are actively involved in curriculum development and design, and 55.9% are in favor of improving students' scientific literacy. However, some teachers rely too much on teaching materials and lack a sense of innovation and personalized teaching, nearly half of the teachers tend to treat students differently, which affects students' motivation and the atmosphere of science education. Therefore, strengthening professional affective literacy and establishing correct teaching concepts and values are the keys to improving teaching quality.

2.2.2. Professional knowledge of science: the cornerstone of scientific literacy enlightenment

The professional knowledge of science teachers is the core element of teaching activities, which is crucial to the enlightenment of students' scientific literacy and the improvement of teaching quality. Teachers in the study generally agreed that it is necessary to learn the knowledge, ideas, methods, history and experiments of science courses. However, due to their specialized educational background, they still face difficulties in building a complete knowledge system. Strengthening the training and learning of specialized knowledge in the science curriculum is of great significance in enhancing the quality of teaching and students' scientific literacy. At the same time, teachers' learning of the new curriculum standards and their ability to apply new teaching models are also important points of investigation. Unfortunately, only a few teachers have studied the new standards in depth, and most of them do not know enough about them; the application of new teaching methods is also limited to some teachers. Therefore, strengthening the learning of the new curriculum and the application of new teaching modes is of great significance in promoting the reform and innovation of science education. In addition, the professional practice knowledge of elementary school science originates from teachers' practical accumulation in science activities, which is an important link between theory and practice. Most teachers can actively carry out post-course reflection and scientific interactive activities, which is conducive to the accumulation of practical knowledge and lays the foundation for the smooth implementation of teaching.

2.2.3. Professional competence in science: the challenge of innovative teaching and research ability

The professional competence of science teachers, especially the ability of innovative teaching and scientific research, is the key to improving their overall quality and teaching quality. The new curriculum emphasizes the diversity and integration of teaching modes, especially the inquiry-based teaching mode. According to the research data, 66.7% of teachers tend to use students' hands-on approach, supplemented by teachers' demonstrations to carry out experimental courses. However, some teachers still have deficiencies in inquiry-based teaching and need to strengthen training and guidance. Meanwhile, research and innovation competence literacy is of great significance in enhancing the comprehensive literacy of elementary school science teachers. However, the reality is that the scientific research output of elementary school science teachers is unsatisfactory, and some of them lack experience in writing papers or have an insufficient sense of innovation. Therefore, strengthening the training and practice of scientific research and innovation ability and encouraging teachers to actively participate in scientific research activities are of great significance in improving the comprehensive literacy and teaching quality of science teachers.

3. Problems and attributions of professionalism of elementary school science teachers in Changsha County

3.1. Analysis of major problems

3.1.1. The lack of science teachers' professional affective literacy: The lack of teaching enthusiasm and innovation

Although most science teachers can stick to their jobs and show a certain sense of obligation and responsibility, only a few of them can draw a sense of achievement and happiness from teaching. Some teachers regard teaching science courses as simple, boring, and mechanical repetitive labor, failing to update

their teaching concepts and explore diversified teaching methods, resulting in a lack of a sense of mission and innovation in their teaching work. With the deepening of the basic education reform, the emerging curriculum concepts conflict with teachers' original concepts, bringing pressure and psychological discrepancy to teachers and causing some of them to waver in their professional ideals. These phenomena show that some teachers have not yet established a deep love and devotion to education work, and their educational sentiment needs to be strengthened.

3.1.2. The singularity of science teachers' professional knowledge structure: The challenge of a comprehensive discipline

As a comprehensive subject covering many fields, the elementary school science curriculum requires teachers to have a broad knowledge base. However, the reality is that most teachers' professional knowledge structure is relatively homogeneous and lacks systematic learning and organization. At the same time, teachers do not learn enough about the educational theories related to the science curriculum, making it difficult for them to teach according to the needs of their students. Some teachers are unfamiliar with the new curriculum standards and have less post-lesson reflection and interactive teaching practice, which is not conducive to the formation of a complete teaching system of scientific knowledge, which in turn affects the implementation of inquiry-based classroom teaching and the cultivation of students' scientific literacy.

3.1.3. Deficiencies in science teachers' professional competence literacy: Utilization of teaching resources and lack of inquiry-based teaching

The findings showed that although most science teachers were able to rationally arrange and complete their teaching tasks, there were obvious deficiencies in the utilization of teaching resources. Teachers failed to fully explore and expand teaching resources and neglected the importance of inquiry-based teaching. In addition, a few new teachers did not implement the experimental teaching properly due to their lack of teaching experience. Nevertheless, most of the teachers expressed a strong desire to improve their research and innovation ability, indicating that they have a positive pursuit of professional competence quality, but they still face many challenges in practice.

3.2. Exploration of influencing factors

3.2.1. Weakness of science teachers' sense of professional development

The professional development of science teachers is a process of continuous improvement of professionalism and personal growth through independent learning. However, due to their long-term marginalized status, science teachers' professional satisfaction has declined, and they are prone to negative emotions, weakening the intrinsic motivation for their professional development. Only a few teachers insist on post-lesson teaching reflection and participation in interactive activities, limiting the improvement and updating of their knowledge system. More seriously, some teachers have not yet studied the new curriculum standards in depth, and their understanding and mastery of the new curriculum concepts are insufficient. Meanwhile, the work pressure brought about by the curriculum reform has prompted teachers to actively participate in various activities, training and lectures, but their non-science background has made them encounter more challenges in the new teaching development path.

3.2.2. Limitations of science teachers' curriculum implementation capabilities

Science teachers not only need to be well-versed in the subject knowledge system but also need to have comprehensive teaching and learning implementation skills. However, the survey results show that some teachers are still unable to effectively adopt the new teaching model and have difficulty in translating theoretical knowledge into classroom practice. This limitation not only affects the quality of teaching but also restricts the development of students' scientific literacy.

3.2.3. Insufficient attention to the teaching of science courses in schools

In the current primary education system, science courses are regarded as auxiliary and are not included in the examination system of primary and junior high school, which leads to a relatively low degree of emphasis on science courses in schools. Some schools even lack science laboratories and necessary experimental equipment, which seriously affects the development and effectiveness of science teaching activities.

3.2.4. Insufficient investment in education

The scale and speed of development of education is closely related to the social and economic support. In recent years, the national investment in education has increased year by year, but compared with the overall international level, there is still a significant gap. This status quo has a direct impact on the resolution of the science teacher establishment and the alleviation of work pressure under the new curriculum standard reform. Inadequate education funding limits science teachers' opportunities for scientific research and innovation, reduces their possibilities to participate in professional training and upgrading, and deprives them of a basic platform for improving their professionalism, hindering the sustainable development of science education.

4. Exploring the optimization path of Changsha County elementary school science teachers' professionalism

4.1. Define development goals and strengthen practical reflection

In the context of rapidly changing science and technology, science teachers should have a forward-looking sense of learning, keep pace with the times, and pay close attention to the latest developments in science education and technology. Based on a deep understanding of their specialties, teachers should clarify the direction of personal development and plan the career development path. At the same time, they should actively participate in teaching skills competitions, and continuously innovate their teaching methods to improve the quality of science classroom teaching through repeated study of teaching materials and practice of lesson grinding. In addition, teachers need to systematically organize, analyze, and reflect on classroom teaching, summarize teaching strengths and weaknesses, and continuously optimize teaching strategies. Through observing, analyzing, and evaluating classroom cases, exploring the laws of education, promoting the collision of thinking and feelings among science teachers, stimulating the spark of wisdom of scientific knowledge, and then comprehensively improving the overall teaching ability of science teachers.

4.2. Deepen the learning and application of the new curriculum standards

Elementary school science textbooks are compiled according to the new science curriculum standards, so science teachers should actively study and deeply understand the new standards, master the latest educational concepts, and integrate them into actual teaching. Combined with the curriculum concepts of the new standards, teachers should understand the students' mastery of science knowledge at all stages and rationalize

their teaching work. Through in-depth study of the new curriculum standard, combined with teaching practice, explore innovative experimental teaching methods and stimulate teachers' innovative thinking. At the same time, by comparing and analyzing the differences and similarities between the traditional curriculum concepts and the latest curriculum concepts, writing papers and publishing new ideas to improve the professional competence of science teachers.

4.3. Raising the importance of science curriculum teaching

Raising the status of elementary school science curriculum teaching is the key to stimulating the continuous improvement of science teachers' professionalism. Schools should pay more attention to the elementary school science curriculum, ensure the full-time nature of the science teacher team, give full humanistic care and support, and help them bravely face the challenges brought about by the new curriculum reform. At the same time, schools should improve the infrastructure of science laboratories and ensure that there is sufficient experimental equipment to guarantee the smooth teaching of science teachers. In addition, schools should provide certain development space for elementary school science teachers, so that they can play a greater role in the limited scope.

4.4. Increase the investment in science education and improve the science education system

The quality of education is positively correlated with the investment in education. The strength of the country depends on talent, and the cultivation of talent relies on education. To build a strong education country, it is necessary to increase the investment in science education, deeply understand the importance and urgency of education investment, and constantly improve the mechanism related to education funding, so as to protect the quality of science teaching and the basic rights and interests of science teachers. At the same time, to avoid the burnout mentality of elementary school science teachers, the education department should formulate relevant policies, improve the mechanism related to science education, and create a pleasant working environment for science teachers, so that they can continuously improve their scientific professionalism with a positive mindset.

5. Conclusion

This paper mainly studies the professional literacy of elementary school science teachers from three dimensions: science professional affective literacy, science professional knowledge literacy, and science professional ability literacy. A questionnaire survey of science teachers in some elementary schools in Changsha County revealed that the lack of professional affective literacy, single knowledge structure, and low professional competence of science teachers are mainly due to the lack of awareness of the professional development of science teachers themselves, the weak ability to implement the curriculum, the lack of attention paid by the schools to the teaching of science courses, and the insufficient funding for science education. Because of the above reasons, corresponding suggestions are put forward to set up development goals and carry out practical reflection, to strengthen the study of the new standard, to pay attention to the teaching of science courses, to increase the investment in science education and to improve the system of science education.

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