

Scientific Literacy, Professional Development, and Support of Teachers in Selected Kindergarten Schools in Guiyang City, China

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Abstract: The study aimed to address the critical issues of scientific literacy among the selected kindergarten teachers by comprehensively assessing their current level of scientific literacy and identifying the influencing factors. The research design was a descriptive quantitative design aimed at assessing and developing the scientific literacy of kindergarten teachers. The primary respondents of this study were teachers from three selected kindergartens in Guiyang City, Guizhou Province. These 147 teachers were responsible for the care and education of children aged 3 to 6 years old in three different early childhood institutions. By focusing on kindergarten teachers, recognizes the direct influence of teachers' scientific literacy on children's scientific literacy in the critical period of children's development. The study concluded:1. The main characteristics of kindergarten teachers in Guiyang City include a predominant age distribution of less than 25 years old, a preponderance of females, a predominance of undergraduate degrees, and a preponderance of 0-3 years of experience in kindergarten teaching. These characteristics provide basic information for understanding the overall literacy level of teachers.2. The overall level of scientific literacy of kindergarten teachers is good. Teachers' mean score of 3.04 in the areas of scientific knowledge, instructional practices, and use of resources indicates that teachers overall have a good level of understanding and application of scientific literacy.3. The personal background of kindergarten teachers had less influence on scientific literacy. Educational background factors such as age, gender, academic qualifications and teaching experience had a small effect on teachers' level of scientific literacy, indicating that educators had relatively consistent levels of scientific literacy across different characteristics.4. Kindergarten teachers are actively involved in professional development. Teachers' mean score for professional development and support was 2.89, indicating that teachers as a whole were actively involved in professional development activities and received some level of support.5. kindergarten teachers' personal backgrounds had less impact on professional development. There were no significant differences in the level of career development and support among teachers of different ages, genders, academic qualifications and teaching experience, indicating that these factors have less influence on teachers' career development support.6. Scientific literacy of kindergarten teachers is significantly associated with career development. There is a significant positive correlation between teachers' level of scientific literacy and their career development and support, emphasizing the importance of improving teachers' scientific literacy for their career development.

Keywords: Scientific Literacy; Professional Development; Teacher Support; Kindergarten Education; China.

1. Introduction

Several years ago, the researcher worked in a kindergarten, in the role of a kindergarten teacher, the researcher has abundant chances to witness fellow kindergarten teachers and young children engaged in science education activities within kindergarten. Extensive observation over time has revealed that, despite utilizing identical teaching plans and materials, the outcomes of science education vary significantly. This disparity primarily stems from variations in the scientific literacy of kindergarten teachers. Diverse kindergarten teachers possess distinct levels of scientific knowledge, practical experience, and material utilization skills, all of which impact the quality of science education.

After that, the researcher worked at a normal university for the past thirteen years, specifically focusing on teaching undergraduates about science education courses designed for kindergarten children. Throughout this extensive period of teaching and mentoring, the researcher has had the opportunity to guide and nurture numerous aspiring science teachers specializing in kindergarten education. This invaluable experience has deepened the researcher's passion

for the field, igniting a profound interest in the field of teachers' scientific literacy.

The scientific literacy of kindergarten teachers is very important. First of all, excellent teachers with scientific literacy can adopt effective teaching strategies to guide children to learn science and trigger children's desire to explore the natural world. Teachers will encourage children to observe and ask questions, promote discussion, and promote children's critical thinking and problem-solving skills. This early training can give children an interest in science that will last a lifetime. Second, only teachers with a high level of scientific literacy can provide children with correct scientific knowledge and scientific methods. Thirdly, kindergarten teachers have different levels of scientific literacy and different ability of interdisciplinary integration. Kindergarten teachers with scientific literacy can integrate science into all aspects of other courses, and even integrate science into children's daily life, providing children with an interdisciplinary learning environment and learning opportunities, so that children can learn science more effectively.

In this research, the writer's primary aim is to enhance the

abilities in cultivating and shaping the next generation of kindergarten teachers. The intersection of the researcher's years in kindergarten education and university-level instruction, along with the training of a substantial cohort of kindergarten science teachers, has underscored the critical significance of scientific literacy among young learners. Through this research, the researcher aspires to contribute to the advancement of science education for kindergarten children, equipping future teachers with the knowledge and skills necessary to inspire curiosity, critical thinking, and a lifelong love for science in the young minds they will nurture.

2. Statement of the Problem

The objective of the study is to assess scientific literacy among kindergarten teachers, recognizing their pivotal role in shaping young children's early science education. Scientific literacy encompasses not only the understanding of scientific concepts but also the ability to apply them effectively in teaching practices, thereby nurturing young learners' curiosity and critical thinking abilities.

Specifically, this study answered the following research questions:

1. What is the profile of the kindergarten teacher respondents in terms of:

- 1.1 age
- 1.2 sex
- 1.3 educational attainment
- 1.4 Years of experience as a kindergarten teacher

2. What is the assessment of the kindergarten teacher respondents on their current level of scientific literacy?

- 2.1 Scientific knowledge
- 2.2 Teaching practices
- 2.3 Resource utilization

3. Is there a significant difference on the assessment of the teacher respondents on the current level of scientific literacy when profile is taken as test factors?

4. What is the assessment of the kindergarten teacher respondents on their professional development and support in terms of:

- 4.1 professional development
- 4.2 professional support

5. Is there a significant difference between the assessment of the kindergarten teacher respondents on their current level of scientific literacy and professional development when profile is taken as a test factor?

6. Is there a significant relationship between the assessment of the kindergarten teacher respondents on their current level of scientific literacy and professional development and support?

7. Based on the result of the study, what development program can be suggested?

3. Hypotheses

The following null hypothesis were tested in this study:

Ho1: There is no significant difference on the assessment of the teacher respondents on the current level of scientific literacy when profile is taken as test factors

Ho2: There is no significant relationship between the assessment of the teacher respondents on their current level of scientific literacy on their professional development and support.

4. METHODOLOGY

4.1. Research Design

The research design is a descriptive-correlational quantitative design, employed to assess and foster scientific literacy among kindergarten teachers. This methodology aims to investigate the existing levels of scientific literacy among a sample of kindergarten teachers and to get an idea on how to enhance teachers' scientific literacy skills.

Therefore, this research incorporated quantitative data gathering focused on the subject of scientific literacy. By conducting thorough assessments and inquiries, researcher quantify the extent of scientific literacy and identify the factors that influence it. This approach ensures precise measurement and rigorous statistical analysis.

The study addresses quantitative research questions related to scientific literacy and influencing factors. A descriptive quantitative design is well-suited to tackle these complex questions.

After analyzing quantitative data, the results were integrated to provide a comprehensive understanding of the scientific literacy levels of kindergarten teachers and the influencing factors.

In conclusion, the descriptive quantitative design is well-suited for this research. This approach providing a rich and nuanced understanding of the research questions and enhancing the validity and reliability of the study's findings.

4.2. Research Locale

This study is primarily conducted within three selected kindergarten settings in Guiyang city, China. The three early childhood institutions were distributed in different districts of the same city. Guiyang city serves as the backdrop against which the scientific literacy of kindergarten teachers is assessed.

4.3. Respondents

The primary respondents in this study are kindergarten teachers within three selected kindergartens in Guiyang city of Guizhou province. These 147 teachers responsible for the care and education of children aged three to six in three various early childhood institutions. By focusing on kindergarten teachers, this research recognizes their direct impact on young children's scientific literacy during this crucial developmental period.

The study ensured that the research objectives, locale, and respondents are in harmony with the questionnaire design and data collection process. The research seeks to address the critical problem of scientific literacy among kindergarten teachers within the selected kindergartens by comprehensively assessing their current scientific literacy levels and identifying influencing factors. The serves as a compass, guiding the research towards these vital objectives while remaining parallel to the questionnaires used in data collection.

4.4. Sampling Method

The research primarily focused on kindergarten teachers working within three selected kindergarten settings in Guiyang city. The target population for this study includes all kindergarten teachers within three selected kindergarten settings in Guiyang city.

The respondents of the study are kindergarten teachers within three selected kindergartens. They represent a diverse

group of professionals responsible for the care and education of children aged three to six. These teachers may have varying levels of educational attainment, teaching experience, scientific knowledge, teaching practice, professional development and support and resource utilization toward scientific literacy, making them a crucial and diverse group for analysis.

Respondents were selected systematically from each school according to its total number. This systematic selection ensures that the sample reflects the distribution of teachers across different schools. Using Qualtrics Calculator 147 kindergarten teachers were the sample respondents out of 237 total population of teachers.

4.5. Sampling Technique

The sampling technique employed for this research was stratified random sampling. This technique involves the following steps:

Firstly, the population was divided into strata based on different schools. There are 106 teachers in School A, 83 in School B, and 48 in school C, with a total of 237 teachers. The number of participants in the three selected schools were determined according to the ratio of the sample number of each school to the total number of participants. The total number of the three schools is 237, if the confidence level is 95%, margin of error is 5%, by using the population size 237, and the researcher can get ideal sample size which is 147. Resulting in a ratio of sample size to the population is 62%. Therefore, the number of participant teachers in school A is $106 \times 0.62 = 66$; $83 \times 0.62 = 51$ teachers in school B; The number of participant teachers in school C is $48 \times 0.62 = 30$. A total of 147 participants were enrolled.

Secondly, within each stratum, a random sample of teachers was selected. This randomization ensures that the sample represents the diversity of the population, accounting for various factors that may influence scientific literacy.

In summary, the sampling method for this study involves stratified random sampling within three selected kindergartens in Guiyang city to ensure a representative sample of kindergarten teachers.

4.6. Research Instrument

The research instruments is a researcher made instrument for this study include both self-report questionnaires and professional development questionnaires.

Kindergarten Teachers' Scientific Literacy Assessment Questionnaire.

The kindergarten teachers' scientific literacy assessment questionnaire used in this study are developed based on a thorough review of the existing literature on scientific literacy which including scientific knowledge, teaching practices and resource utilization.

The kindergarten teachers' scientific literacy assessment questionnaire was developed through a process of item generation, item refinement, and pilot testing with a sample of kindergarten teachers. 30 respondents were pretested by this questionnaire, these respondents not included in the sample size. Feedback from pilot testing was used to refine the wording and structure of the questionnaires. The questionnaires were also reviewed by 5 experts in early childhood education and science education to ensure content validity.

To evaluate the reliability of the scientific literacy assessment questionnaire for kindergarten teachers,

researcher employed internal consistency reliability measures, notably Cronbach's alpha. Cronbach's alpha assesses the extent to which items within each construct in the questionnaire exhibit internal coherence. A higher Cronbach's alpha score signifies that the items within a scale consistently measure the same underlying construct.

Prior to the formal distribution of the questionnaire, 30 respondents were randomly selected for pre-testing of the questionnaire. Then the reliability and validity tests of the questionnaire were conducted.

5. Conclusion

Based on the presented findings of the study, the researcher came up with the following conclusions:

1. The main characteristics of kindergarten teachers in Guiyang City include a predominant age distribution of less than 25 years old, a preponderance of females, a predominance of undergraduate degrees, and a preponderance of 0-3 years of experience in kindergarten teaching. These characteristics provide basic information for understanding the overall literacy level of teachers.

2. The overall level of scientific literacy of kindergarten teachers is good. Teachers' in the areas of scientific knowledge, instructional practices, and use of resources indicates that teachers overall have a good level of understanding and application of scientific literacy.

3. The personal background of kindergarten teachers had less influence on scientific literacy. Educational background factors such as age, gender, academic qualifications and teaching experience had a small effect on teachers' level of scientific literacy, indicating that educators had relatively consistent levels of scientific literacy across different characteristics.

4. Kindergarten teachers are actively involved in professional development. Teachers' in terms of professional development and support, indicates that teachers as a whole were actively involved in professional development activities and received some level of support.

5. Kindergarten teachers' personal backgrounds had less impact on professional development. There were no significant differences in the level of career development and support among teachers of different ages, genders, academic qualifications and teaching experience, indicating that these factors have less influence on teachers' career development support.

6. Scientific literacy of kindergarten teachers is significantly associated with career development. There is a significant positive correlation between teachers' level of scientific literacy and their career development and support, emphasizing the importance of improving teachers' scientific literacy for their career development.

6. Recommendations

Based on the conclusions derived in this study, the following are the recommendations:

1. Enhanced training for teachers in scientific literacy: In view of the good performance of teachers' overall level of scientific literacy, it is recommended that schools and relevant organizations continue to enhance training for teachers in scientific literacy to ensure that they are able to keep abreast of the latest developments in the field of science education.

2. Individualized career development plans: Although age, gender, academic qualifications and teaching experience have

relatively little impact on teachers' scientific literacy and career development, it is recommended that schools develop individualized career development plans to better meet the individual needs of teachers.

3. Promote co-operation and exchanges among teachers: Encourage co-operation and exchanges among teachers, especially in science education. Schools may organize regular teaching seminars and workshops to facilitate experience sharing and professional growth.

4. Provide diversified support for professional development: Schools should provide diversified support for professional development, including participation in professional organizations in science education, attendance at relevant seminars and the use of online resources, etc., in order to help teachers to continuously improve in different aspects.

5. Regular evaluation and updating of training program: Schools and organizations should regularly evaluate existing training programs, and update and adjust them according to teachers' feedback and development needs, to ensure that the training programs remain efficient and relevant.

7. Output of the Study

7.1. Development Program for Scientific Literacy for Teachers

Rationale:

Table 1. Development Program

Key Result Areas	Objectives	Activities/Strategies	Persons Involved	Time Frame	Budget
Scientific Knowledge Training	Improve the level of scientific literacy of teachers.	1. Workshops for teachers gain knowledge on how to improve the kindergarten science curriculum. 2. Teachers are trained to design practical lessons that integrate scientific knowledge into fun teaching activities. 3. Professional Development Forums where teachers are invited to share the latest scientific developments and teaching methods.	Program Managers, School Leaders and Teachers	Before the opening of the school year	20,000 RMB
Optimizing Teaching Practice	Provide training in a variety of teaching methods, including cooperative group learning, practical inquiry, and so on.	1. Workshops on Teaching Methods and Teaching Strategies 2. Classroom Observation: organize classroom observation for teachers to learn and share good teaching practices.	Program Managers, School Leaders and Teachers	Ongoing	10,000 RMB
Upgrading of resource utilization skills.	Participate actively in the activities	1. Training seminars on teaching materials: Training seminars are held to teach the use of science teaching materials. 2. Resource Integration Practices: Teachers are guided to design and implement science teaching programs that integrate multiple resources.	Program Managers, School Leaders and Teachers	Whole year round	3,000 RMB
Promoting of a scientific culture in schools.	To create a positive scientific atmosphere, including organizing science demonstration activities, and encouraging scientific enquiry.	1. School Science Fair is organized once a year for students to present their science projects. Science Parent Conferences: are organized to share science education resources and home practices. 2. Cooperative activities: Regular co-operative activities are organized to foster the spirit of teamwork among teachers.	Program Managers, School Leaders and Teachers	Whole year round	13,000RMB

2. Teachers will adopt diversified teaching methods to enhance students' participation and initiative. Teachers will continually improve their teaching methods through reflection and adaptation to enhance overall teaching effectiveness. Teachers will form a learning organization, learning from each other and sharing good teaching practices.

3. Teachers are able to use science teaching materials

This program is based on the findings of this study and adapts to the needs of modern society for highly qualified teachers with scientific literacy, especially at the kindergarten level. Early childhood is a critical period for children's cognitive development, and the guidance and nurturing of science education will lay a solid foundation for their future learning. However, this study identifies gaps in scientific literacy, teaching practices, and resource utilization among kindergarten teachers. Through the Science Education Elite Program, we are committed to providing comprehensive training and support to advance the science education standards of kindergarten teachers so that they can better meet children's learning needs and develop students' interest and understanding of science.

Goals:

1. Teachers will have a deeper understanding of scientific knowledge and will be able to teach relevant scientific concepts with greater confidence. Teachers will be more flexible in applying theoretical knowledge and designing interesting practical activities in science practice. Teachers will be better able to combine scientific knowledge with practical experience to enhance the fun and relevance of science education.

skillfully and increase the efficiency of classroom resources. Teachers are able to innovatively integrate various resources in their teaching and expand the diversity of science education. The school will set up a more comprehensive science education resource bank to provide teachers with more support.

4. School science demonstration activities will become a

tradition in schools, stimulating students' interest in science. Home-school co-operation will be strengthened and parents will be more active in supporting students to practice science at home. Schools will be at the forefront of building a science culture and providing a richer science learning environment for students.

5. Teacher teams will collaborate more closely with each other to form learning communities that are conducive to pedagogical innovation. Teachers will be more willing to share experiences and resources to create a climate of shared learning. Teacher teamwork will become an important cultural feature of the school, supporting the overall quality of education.

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