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Research Article

NATURAL SCIENCE TEXTBOOK AND THE CURRENT PREPAREDNESS OF TEACHERS IN TEACHING THIS SUBJECT

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ABSTRACT

In developed European countries, the content of Natural Science (Science) has played a significant role in national curricula over the past thirty years. Understanding the concept of Natural Science (Science) content, which is an important component of scientific literacy and integrates natural sciences, history of science, sociology of science, and philosophy of psychology, is essential for teachers and students to be scientifically literate. This understanding involves a combination of key structures of scientific activity and the knowledge of natural science, which are necessary for scientific literacy [1,2,3].

KEYWORDS

Natural sciences, history of science, sociology of science, and philosophy of psychology.

INTRODUCTION

Today, in response to the demands of the modern world, there is a shift in the approach to teaching natural sciences, moving from the study of each subject individually to an integrated system. This integration of knowledge in natural sciences has become the foundational concept of the subject itself. This trend is evident not only globally but also in our own country.

In our country, work on developing the national curriculum began in 2020. On May 11, 2022, the President of the Republic of Uzbekistan signed Decree No. 134 on 'Approval of the National Program for the Development of Public Education for 2022-2026.' According to part 3, item 'a' of this decree, the full implementation of the National Curriculum in the educational process is to be completed by September

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1, 2024. This includes the creation of textbooks, exercise books, and teaching manuals for grades 3, 6, 7, and 10 by the end of 2022, and for grades 4, 5, 8, 9, and 11 during the 2023-2024 academic year.

In this regard, starting from the 2022-2023 academic year, the teaching of Natural Science (Science) in grade 6 was implemented based on the national curriculum. The main goal of teaching Natural Science (Science) is to develop students' ability to analyze natural processes and phenomena, to form a systematic and integrated approach to understanding them, and to establish a general scientific methodology for studying the natural sciences, with the aim of shaping a unified scientific worldview.

Literature Review

Natural Science (Science) teachers have been striving to teach the content of the subject in their lessons. Despite these efforts, science teachers have not reached a consensus on understanding the essence of the subject. This is because the concepts related to the nature of science, as well as our perceptions and views of science, are constantly changing and developing.

Komas and Olson consider natural science (Science) as a field where various disciplines intersect, such as philosophy of science, history of science, sociology of science, and psychology of science [2]. According to Ledermann, the content of natural science (Science) is "'...the epistemological method of knowing science, or the values and beliefs characteristic of the development of scientific knowledge...' [3]. According to NGSS, '...science can be defined as a way of knowing about the natural and physical world and as a human endeavor, with scientific knowledge being based on empirical evidence and open to revision based on new evidence..." [4]. There is no single definition that explains the essence of the content of Natural Science (Science), but despite some differences, many researchers have reached a consensus on the criteria for the content of Natural Science (Science). According to international standards for science education and the research of several scholars who have worked in the field of natural sciences for many years, the criteria for expressing the content of Natural Science (Science) (Lederman, Abd El Khalik, McComas) are explained as follows:

1. Scientific knowledge is based on empirical evidence and arises from observations of the natural world: Scientists require experimental evidence to create new knowledge. New experimental evidence necessitates the revision of scientific knowledge [5].

2. The difference between observation and inference: Observations are descriptive explanations that can be directly obtained through the senses from natural phenomena. Inferences are statements and explanations that cannot be directly derived from the senses and observations, but are interpretations of them. [6].

3. Scientific knowledge is provisional and may change as a result of development: Scientific knowledge can change due to advancements in technology and information resources, the acquisition of new evidence, the reinterpretation and re-understanding of existing evidence, or changes in social life. What we consider to be true now may not be recognized as such in the future. [7].

4. Scientific knowledge encompasses human conclusions, imagination, and creativity: Scientific concepts are not a direct reflection of reality; they are explanations produced by scientists based on observations, experiments, and inferences, using their imagination and creativity. [8].

5. Scientific knowledge is infused with social and cultural aspects: Natural science (Science) is a human activity influenced by the social environment, cultural

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and economic factors, religious and philosophical views, political structures, and the scientific knowledge embedded within these elements. [9].

6. Scientific knowledge is subjective (theory-based): Scientific knowledge is created based on theoretical foundations. From the development of scientific issues to the interpretation of collected data and scientific observations, these are all related to theory. Scientific data incorporates subjectivity. The prior knowledge, views, experiences, and theory-based research of scientists influence their approach to solving problems and interpreting observations. [9].

7. Global views on scientific methodology: The idea that there is a single scientific method universally applied in natural sciences (Science) by all scientists is one of the common misconceptions among people. In science, there are many activities such as observation, measurement, experimentation, evaluation, and hypothesis formulation, but these activities do not have to follow a specific sequence [6]. Furthermore, scientists may use different methods in their research and can change their methods at any point in their work.

8. The difference between scientific laws and theories: Theories are a coherent set of explanations based on observations of the natural world, attempting to explain the causes and effects of natural phenomena, while laws are generalizations and principles. They describe how a phenomenon occurs in nature or how it can be observed. [2,6];

Several developed countries, such as Singapore, the USA, the UK, Turkey, and Greece, use the above consensus as a principle when analyzing the natural science curriculum.

METHODOLOGY

Additionally, more hours have been allocated to practical activities in the natural science (Science) curriculum, and project work has been included [6]. This helps students develop research skills and enables them to create their own project work in the future.

In the rapidly developing era of science and technology, teachers must constantly improve their pedagogical preparedness to possess adequate teaching capabilities. The professional development of general education and natural science teachers is based on: (1) the objective requirements of educational institutions and other professional standards, and (2) the development demands of teachers' own pedagogical preparation. The experience of other countries shows that when the professional development of teachers aligns with their personal needs, the forms of professional development become truly beneficial and engage teachers voluntarily.

RESULTS

Analyzing the current state of professional development for natural science (Science) teachers in general secondary education schools reveals that in many professional development institutions, there are no structured programs specifically aimed at enhancing the qualifications of natural science (Science) teachers. When analyzing the quality and effectiveness of the methodological support provided to natural science teachers, it became apparent that the number of resources and teaching manuals created and published for natural science teachers is very limited. Additionally, the available manuals are primarily designed for primary school teachers.

During the pedagogical trial and experimental work, when observing natural science (Science) lessons for 6th grade students in general secondary schools, the following issues were clearly observed: the teacher primarily conducts the lesson in a lecture format based

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on the textbook material. Additional literature is not used (as there is a lack of available resources). Students are rarely engaged in creative or practical activities. During the lesson, only five or six active students are involved, while the rest are neglected. There is a one-size-fits-all approach to all students. As a result, students' life skills and the ability to solve complex, problem-solving tasks independently are not developed. Often, students simply memorize ready-made knowledge and recite it based on their abilities. As a result, the student remains an object in the educational process, rather than being an active subject.

Therefore, we believe that in the process of continuous professional development, teachers of natural sciences should be provided with various activities, such as short-term courses, seminars and training sessions, online courses, methodological meetings, individual learning trajectories, and cooperation opportunities. These measures should aim to enhance teachers' ability to teach natural sciences and develop natural literacy skills.

In addition to how educational and developmental activities are organized, the mastery of natural science knowledge by students and their development into scientifically literate individuals also depends on the teacher's level of expertise in natural sciences, their educational-methodological preparation, and the quality and level of textbooks and teaching manuals.

CONCLUSION

From the above, it is clear that, unfortunately, at present, comprehensive preparation for natural science teachers has not been established. Therefore, in the current stage of education modernization, it is possible and appropriate to implement such training within the system of professional development for educators.

As is well known, the educational-methodological preparedness of a natural science (Science) teacher improves through their pedagogical activities: working on themselves, acquiring knowledge in natural sciences, continuously mastering modern and innovative technologies, and staying informed about new developments in global education.

If the development of natural science teachers' educational-methodological preparedness is carried out within the process of professional development, the teaching of natural sciences in general education schools will become much more effective, and the system of teaching natural sciences will lead to the expected outcomes.

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