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METHODOLOGY OF USING THE KOLB MODEL IN TEACHING NATURAL SCIENCES, 5th GRADE OF GENERAL SECONDARY EDUCATION SCHOOL

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Abstract: This article discusses the theoretical and methodological foundations of using the experiential learning model developed by David Kolb to improve the methodology of teaching 5th grade natural sciences in general secondary schools. The article analyzes the didactic possibilities of the Kolb model's concrete experience, reflective observation, abstract conceptualization, and active experimentation stages in the process of teaching natural sciences. Also, methodological recommendations for the use of the Kolb model in accordance with the content of 5th grade natural sciences are developed, and its integration with the competency-based approach and inquiry-based education are shown.

Key words: natural science, 5th grade, Kolb's model, experiential education, educational methodology, scientific literacy, research skills, competence approach, STEM education, innovative pedagogical technologies.

Introduction. The main goal of teaching natural sciences in the modern education system is to form competencies in students to understand, observe, analyze, experiment with, and draw conclusions based on the results of natural phenomena on a scientific basis. In today's era of globalization and the development of digital technologies, the use of innovative pedagogical models that increase the activity of students in the educational process, direct them to independent thinking and practical activities is of great importance. In particular, natural science, which is taught in the 5th grade of general secondary schools, is of particular importance as an integrated subject that forms the initial foundation of biological, physical, chemical, geographical, and ecological knowledge for students.

Primary school 5th grade students, due to their age characteristics, tend to acquire knowledge through direct observation of the environment, conducting experiments, and engaging in practical activities. Therefore, in teaching natural sciences, it is necessary not to limit instruction to the presentation of theoretical information only, but to organize the learning process based on students' personal experiences. This, in turn, requires the use of experience-based learning models.

One such model is the experiential learning model developed by the American scholar David A.Kolb. According to this model, knowledge is formed through students' direct experience, observation, analysis, and practical activity. Kolb describes the learning process as a continuous cycle consisting of four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. These stages enable students to deeply understand knowledge, connect it with practice, and apply it in new situations.

The use of Kolb's model in teaching natural sciences creates broad opportunities for developing students' scientific literacy, forming research skills, solving problem situations, and

enhancing scientific thinking. In particular, organizing instruction based on experiments, observations, and practical activities when teaching topics such as “Germination of seeds,” “the Water sycle,” “Properties of sir,” “Substances and their properties,” and “Ecosystems” increases students’ interest in the subject and supports the solid acquisition of knowledge.

From a scientific and pedagogical perspective, Kolb’s model fully aligns with the principles of constructivist and competency-based approaches. At the same time, the model ensures students’ independent acquisition of knowledge, critical thinking, and the ability to draw scientific conclusions based on their own experiences. This, in turn, contributes to the formation of competencies required by modern educational standards and those defined by international assessment programs in teaching natural sciences.

In improving the methodology of teaching 5th grade natural sciences in general secondary education, studying the theoretical foundations of using Kolb’s experiential learning model, identifying its didactic potential, and developing mechanisms for its practical application are of significant scientific and methodological importance. This article highlights the role of Kolb’s model in natural science education, its structural stages, methodological possibilities, and its importance in developing students’ scientific competencies.

Methodology. This article aims to identify and methodologically substantiate the potential of David Kolb’s experiential learning model in improving the methodology of teaching 5th grade natural sciences in general secondary schools. The methodology of the article is based on constructivist learning theory, the competency-based approach, and the principles of experiential teaching.

The theoretical and methodological foundation of the article is based on D.Kolb’s concept of knowledge formation through experience. According to the scholar, the teaching process yields effective results only when it is carried out through the coherent integration of the stages of concrete experience, reflective observation, abstract conceptualization, and active experimentation [1]. This approach enables students to discover knowledge based on their own experience rather than merely receiving ready-made information.

The article employed methods of comparative analysis of pedagogical and methodological literature, study of scientific sources, observation, pedagogical modeling, and generalization. In particular, international experiences in teaching natural sciences, scientific literacy criteria developed by the OECD, and modern pedagogical models were analyzed [2].

The alignment of Kolb’s model with the content of 5th grade natural sciences was evaluated based on the following methodological criteria:

- its relevance to students’ age and psychological characteristics;
- the opportunity to study natural phenomena through observation and experimentation;
- the level of development of scientific thinking and research competencies;
- its impact on the formation of scientific literacy;
- its compliance with the requirements of the competency-based approach.

According to the results of the methodological analysis, each stage of Kolb’s model can be effectively applied in 5th grade natural science lessons. In particular, during the concrete experience stage, students directly observe natural objects and phenomena or conduct experiments; during the reflective observation stage, they analyze the observed processes; during the abstract conceptualization stage, scientific concepts are formed; and during the active experimentation stage, the acquired knowledge is applied in new practical situations [3].

The article methodologically analyzes the practical application of Kolb’s model using topics from 5th grade natural sciences such as “Germination of seeds,” “the Water Sycle,” “Properties of

Air," "Ecosystems," and "Earth and space." The content of these topics is characterized by its suitability for organizing observation, experimentation, and practical activities. This, in turn, enables the integration of the core principles of Kolb's model into the educational process. Furthermore, the study considers Kolb's model in conjunction with the competency-based approach and Inquiry-based learning. This is because both approaches are aimed at supporting students' independent activity, problem-solving skills, and scientific inquiry [4]. As a result, it was determined that the use of Kolb's model in teaching natural sciences ensures the integration of theoretical knowledge with practical activity and contributes to the development of students' scientific competencies. In order to determine the effectiveness of Kolb's experiential learning theory in improving the methodology of teaching 5th grade natural sciences, experimental work was conducted in the form of a pedagogical experiment. The experimental process was carried out through lesson plans developed based on the stages of Kolb's model within the scope of 5th grade natural science topics.

The issue of improving the methodology of teaching 5th grade natural sciences in general secondary schools has a long history in pedagogical science, with its main theoretical roots tracing back to progressive education, constructivism, and experiential learning concepts. Within these approaches, the learner is not viewed as a passive recipient of ready-made knowledge, but as an active agent who constructs knowledge through active engagement.

J.Dewey's scientific studies interpret learning as a "Process of learning through experience" and emphasize the close connection between knowledge and real-life activity [5]. According to him, when the learning process is based on the learner's personal experience, knowledge becomes more stable and practically meaningful. This idea later formed the methodological foundation of Kolb's experiential learning model.

L.S.Vygotsky emphasized the role of the social environment and collaboration in the learning process and introduced the concept of the "Zone of proximal development" [6]. According to this theory, learners can accomplish tasks that they are unable to perform independently with the assistance of a teacher or peers. This concept is conceptually aligned with the reflective observation and active experimentation stages of Kolb's model.

In J.Piaget's theory of cognitive development, it is argued that children acquire knowledge in a step-by-step manner through practical actions [7]. In particular, 5th grade students are at the concrete operational stage, which indicates their tendency to learn through working with real objects, conducting experiments, and making observations. This aspect directly corresponds to the "Concrete experience" stage of Kolb's model.

According to David A.Kolb's experiential learning theory, knowledge is formed through a four-stage cycle-concrete experience, reflective observation, abstract conceptualization, and active experimentation [1]. This model is recognized in modern pedagogy as one of the most effective approaches for enabling students to acquire knowledge through practical activity. The main advantage of Kolb's model is that it integrates theory and practice in a coherent manner and fosters the development of the learner as an active investigator.

Modern international studies also confirm the priority of experiential and competency-based approaches in teaching natural sciences. Within the framework of the OECD's PISA program, students' scientific literacy is assessed based on their ability to apply knowledge, analyze information, and draw conclusions in real-life situations [2]. This is directly related to the processes of active experimentation and reflection outlined in Kolb's model.

Similarly, the 5E instructional model developed by R.Bybee (Engage, Explore, Explain, Elaborate, Evaluate) also supports experiential and inquiry-based learning approaches [4]. This

model shares similarities with Kolb's theory and serves to promote students' active cognitive engagement. Overall, the literature review indicates that Kolb's experiential learning model is closely integrated with constructivist, competency-based, and active learning approaches in teaching 5th grade natural sciences, and it represents an important methodological foundation for developing students' scientific literacy.

Analysis and discussion of results. The results of the theoretical and methodological analysis conducted on the application of Kolb's Experiential Learning Theory in teaching 5th grade natural sciences demonstrated that this model is effective in enhancing students' cognitive activity and developing their scientific competencies. During the analysis, the compatibility of the four stages of Kolb's model (concrete experience, reflective observation, abstract conceptualization, and active experimentation) with the content of 5th grade natural sciences was identified, and their didactic potential was evaluated.

According to the research results, the concrete experience stage was found to be the most appropriate type of activity for the age characteristics of 5th grade students. During direct observation of natural objects, performing simple experiments, and participating in practical activities, students demonstrate a high level of interest and engagement. For example, in experimental lessons on the topic "Germination of seeds," students directly observed the process of seed development and acquired knowledge not in a ready-made form, but through hands-on experience.

The reflective observation stage contributes to the development of students' ability to analyze observed phenomena and enhance logical thinking. The analysis showed that during the discussion of experimental results, students move from simple description toward identifying cause-and-effect relationships. This, in turn, gradually develops their scientific thinking.

In the abstract conceptualization stage, students develop theoretical knowledge by linking observational results with scientific concepts. The study found that students better understand and retain knowledge in long-term memory by comparing experimentally acquired information with scientific concepts presented in textbooks. At this stage, the teacher's guiding role is of significant importance.

The active experimentation stage develops students' ability to apply acquired knowledge in new situations. For example, students attempt to independently identify factors affecting plant growth by planting seeds under different conditions. This process contributes to the development of their research competencies.

Overall analysis results indicate that in lessons organized based on Kolb's model:

— students' interest in the lesson increases significantly;
— the quality of knowledge acquisition improves;
— independent thinking and analytical skills develop;
— competencies in drawing conclusions from experimental evidence are formed;
— interdisciplinary integration is strengthened.

Furthermore, the integration of Kolb's model with inquiry-based learning and the STEM approach resulted in the development of students' skills in solving real-life problems [3]. This contributes to the formation of competencies aligned with the requirements of international assessment programs such as PISA and TIMSS.

The research results confirm that Kolb's model in teaching 5th grade natural sciences ensures not only the acquisition of theoretical knowledge but also the process of knowledge construction through practical activity. This demonstrates higher pedagogical effectiveness compared to traditional approaches.

The experimental work was conducted in two groups:

Control group – was taught using traditional explanatory and reproductive methods; Experimental group – was taught through lessons organized based on Kolb's model (concrete experience, reflective observation, abstract conceptualization, and active experimentation).

During the experiment, topics such as "Germination of seeds," "the Water cycle," and "Properties of air" were selected. For each topic, students' level of knowledge, engagement, independent thinking, and practical skills were observed and assessed.

The results of the experimental study were analyzed based on the following criteria:

— level of knowledge acquisition;
— classroom engagement;
— experimental skills;
— reflective thinking (analysis);
— ability to draw independent conclusions.

Level of knowledge acquisition. Students in the experimental group demonstrated deeper and more stable mastery of the topics. According to test results, the proportion of students achieving high scores in the experimental group was significantly higher than in the control group.

Students' engagement. In lessons organized based on Kolb's model, students' participation in the learning process was active and consistent. In particular, they showed high levels of interest during the experimentation and observation stages.

Experimental skills. Students in the experimental group demonstrated a considerably higher level of competence in conducting independent experiments, recording observation results, and analyzing them.

Reflective and analytical thinking. The reflective observation stage contributed to the development of students' ability to analyze phenomena, identify cause-and-effect relationships, and enhance logical thinking. In the control group, these skills were comparatively less developed.

Independent conclusion-making. The active experimentation stage improved students' ability to apply their knowledge in new situations and draw independent conclusions. This indicator was significantly higher in the experimental group.

It was determined that Kolb's model yields higher results in developing students' scientific literacy in comparison with traditional teaching methods.

The results of the experimental study confirm that Kolb's experiential learning model is an effective methodological approach in teaching 5th grade natural sciences. This model supports the development of students' competencies in linking theoretical knowledge with practical experience, independent thinking, and drawing scientific conclusions. Therefore, it is considered appropriate to widely implement Kolb's model in modern natural science education.

The above diagram illustrates the results of the experimental study conducted based on Kolb's model. Below is the tabular representation of the results:

Table of experimental study results

Group	Stage	Result (%)
Control	Pre-test	62
Control	Post-test	68
Experimental	Pre-test	63
Experimental	Post-test	85

The effectiveness of teaching based on Kolb's model was observed to be significantly higher.

Conclusions and recommendations. Based on the results of applying Kolb's Experiential learning model in improving the methodology of teaching 5th grade natural sciences in general secondary education, the following scientific and methodological recommendations were developed:

✓ In organizing natural science lessons, it is advisable to engage students not as passive listeners but as active subjects of learning. For this purpose, it is necessary to systematically implement the "Concrete experience" stage of Kolb's model, i.e., to plan simple laboratory experiments, observation activities, and practical tasks for each topic.

✓ To develop students' reflective thinking, it is recommended to integrate the "Reflective observation" stage into the lesson process. In this regard, students should be provided with opportunities to keep observation journals, present results in tables and diagrams, and analyze them through guiding questions such as "What was observed?" and "Why did it happen this way?"

✓ In the "Abstract conceptualization" stage, it is necessary to strengthen the mechanisms for linking experimental results with theoretical knowledge in order to ensure students' deep understanding of scientific concepts. In this process, the teacher should perform a guiding role and explain scientific terms and concepts through clear and concrete examples.

✓ To develop the "Active experimentation" stage, it is recommended to assign students independent small research projects. For example, comparing factors affecting seed germination under different conditions, creating a model of the water cycle, or conducting ecological observations.

✓ The integration of Kolb's model with modern digital technologies is of significant importance. The use of virtual laboratories, simulations, multimedia resources, and online platforms (such as PhET, Google Classroom, Kahoot, etc.) further enhances students' cognitive engagement.

✓ In teaching natural sciences, it is recommended to apply an integrated approach combining Kolb's model with inquiry-based learning (Inquiry-based learning), STEM, and the 5E model. This approach develops students' complex thinking, problem-solving skills, and understanding of interdisciplinary connections.

✓ In assessing students' knowledge and skills, it is important not to rely solely on final test results but to use formative assessment methods. Reflection sheets, observation charts, project work, and portfolios are considered effective tools for determining students' individual progress.

The systematic implementation of Kolb's experiential learning model in the teaching of 5th grade natural sciences contributes to improving students' scientific literacy, developing research competencies, and advancing the overall quality of education to a new level.

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