

## BUILDING TEACHING CONTENT ON SUBSTANCE AND ENERGY TOPICS IN SCIENCE SUBJECT 4 (2018) IN THE EXPERIENTIAL MODE

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**Abstract.** Experiential learning has been mentioned and directed for implementation in many recent periods of educational reform in our country, especially when implementing the 2018 general education program. However, in reality, not many primary teachers in Ho Chi Minh city apply experiential teaching in Science (2018). Based on the theoretical basis of experiential teaching, the research has proposed four principles when organizing experiential teaching the Substance and Energy topic in Science 4 (2018). At the same time, we build a process for designing lesson plans according to the experiential method including four stages: Determine the goal of organizing teaching according to the experiential method; Determine the content of teaching and learning according to the experiential method; Design experiential learning activities for students; Designing criteria and assessment tools in teaching according to the experiential method of Science 4 (2018). When organizing teaching activities according to the experiential method in teaching Science, follow four steps: Set problems and assign experiential tasks to students; Students perform problem-solving tasks; Organize students to form new concepts on their own; Organize students to experiment in new situations. The research has developed 03 illustrative lesson plans including “Water pollution and protection,” “Sound,” and “Heat transfer and thermal conductors” in the Substance and Energy topic of Science subject 4 (2018) according to the proposed principles and procedures. At the same time, when organizing experimental teaching with lesson plans following the four steps above, the results showed that the test results of students in the experimental class were better than those of students in the control class. Therefore, it can be concluded that the four principles and four steps in the process of designing lesson plans and stages in organizing the teaching of the Substance and Energy topic in Science 4 (2018) according to the experiential method has formed and developed natural science competency components for students according to the requirements to be achieved.

**Keywords:** Experience, Substance, Energy, Science 4, primary school, Ho Chi Minh city.

### 1. Introduction

Teaching capacity development using the experiential method is not a new problem in many countries around the world as well as in Vietnam. When implementing the reform of the general education program (2018), experiential teaching is one of the orientations on teaching methods to develop the competencies and qualities of students [1]. Many domestic and world studies on organizing teaching through experiential activities highlight the advantages of experiential

teaching, which is contributing to changing educational thinking, focusing on learners, and learning activities as the center, towards the development of students' competencies and qualities.

Around the world, experiential teaching methods have attracted the attention of researchers since the late 19th century. Psychologist Kurt Lewin's applied research and experimental training emphasized the close integration of theory and practice. Learning can be maximally effective when there is a close relationship between personal experience and analysis of solving learning tasks [2]. According to Kolb, to develop scientific understanding, we can influence learners' awareness, but to develop and form competencies and qualities, learners need to experience [3]. Silberman, M. L. has published research on experiential learning handbooks with a variety of learning methods such as games, role-playing, storytelling, reflective practice, ... [4]. John Dewey pointed out the limitations of the traditional educational model, which contains many rigid rules, regulations, and procedures, creating an educational environment that limits the accumulation of knowledge, making students passive and uncreative. He also emphasized that experience is central to the learning process because "If you tell me, I will forget. If you instruct me, I will remember half of it. And if you let me do it, I will not forget." [5]. Authors Passarelli, A. and Kolb, D. A. introduced an experiential learning cycle with four stages in order: performing operations and actions; reflecting on experience; conceptual abstraction; and Experimentation and application are connected in a spiral shape towards the goal of continuous learning [6].

In Vietnam, Vu Thi Ngoc Uyen "applied David A. Kolb's experiential education model to teach Nature and Society subjects at primary schools" [7]. Vo Trung Minh analyzed and applied Kolb's experiential education when "applying David Kolb's experiential education model in primary school teaching" with six basic steps to apply this model in teaching and emphasizing the role of personal experience in learning: through experiencing real-life situations, students learn problem-solving and critical thinking skills [8]. Dinh Thi Kim Thoa mentioned the difference between learning by doing, learning through doing, and learning from experience. According to the content of the article, learning from experience is similar to learning through doing, but the difference is that learning from experience must be associated with personal experiences and emotions. The author has also applied theories, models, and learning cycles from David Kolb's experience to teaching and education in schools. According to the author, we can influence learners' awareness to improve scientific understanding, but to develop and form competence, learners must experience it. Experience is an educational activity that connects experiences learned in school with real life, through which experiences will be accumulated and gradually transformed into learners' competencies [9].

The Science subject (2018) is built on the basic, initial foundation of natural science and the fields of health education, environmental education, formation and development of abilities and competencies for primary school students. One of the viewpoints in building the Science curriculum (2018) is to actively engage students in teaching through experiential methods: learning science through exploration, discovery, observation, experimentation, practice, and work in groups,... Thereby, it helps to form and develop scientific cognitive competences; the competences to learn about the surrounding natural environment; the competences to apply scientific knowledge to solve some simple problems in life [10]. On the other hand, experience encourages students to use many senses to perceive surrounding objects and phenomena. The Substance and Energy topics in fourth-grade science include knowledge about nature related to physics and chemistry. When teaching this topic, you can let students experience through observations and experiments,... to learn about things and phenomena to develop scientific competencies.

In Ho Chi Minh City, teachers still encounter many difficulties when designing experiential teaching activities in a scientific way and in accordance with the requirements for innovating the curriculum of subjects in the Education Program (2018). At the same time, there has not been any

work that has done in-depth research on the content and teaching process of Science for fourth-grade students through experiential methods, especially the Substance topic and the Energy topic in the Science subject of the Education Program (2018). Therefore, in this research, we will guide the process design instructions and organize a number of teaching activities on the Substance topic and the Energy topic in the fourth grade Science subject, contributing to improving effective teaching and learning in primary schools according to the orientation of developing qualities and competencies for students.

## **2. Content**

### **2.1. Some concepts**

#### **2.1.1. Teaching**

Teaching is a process of interaction between teachers and students. Under the guidance of teachers, students can find and discover new knowledge that they do not know, forming habits of independent and creative thinking; and at the same time, comprehensively develop life skills and ethical standards in accordance with social standards [11].

#### **2.1.2. Mode**

Mode is a compound word between method and manner. In particular, the method is a systematic way and operating process to achieve a specific goal. Manner is the form in which an activity takes place.

#### **2.1.3. Experience**

According to Dao Thi Ngoc Minh and Nguyen Thi Hang (2018), the process of directly contacting, observing, contemplating, and interacting with the environment, surrounding objects, and phenomena in a positive and proactive way people use their knowledge, experience, living capital... to receive new knowledge which is experience [12].

## **2.2. Research methods**

### **2.2.1. Theoretical research methods**

In this research, theoretical research methods are used to analyze and synthesize documents and theories on teaching Science subject using the experiential method at home and abroad; the Science (2018) serves as a scientific basis for research issues; at the same time, applies theory to build educational activities according to the experiential method in Science subject for fourth-grade students.

### **2.2.2. Experimental method**

This method is used to evaluate the effectiveness of experiential educational content and activities in 03 lesson plans to test the level of scientific capacity development of students. Grade 4 in 02 classes is: Experimental fourth grade (number: 46 students) and control fourth grade (number: 45 students) at Nguyen Thai Son Primary School, District 3, Ho Chi Minh City. During the experiment, survey and compare the results between the experimental class and the control class through the manifestations of each component of scientific capacity formed in students. The experimental period is from September 15, 2023 to November 15, 2023.

### **2.2.3. Mathematical statistical methods**

Using mathematical statistical methods to process data and results of pedagogical experiments to evaluate the effectiveness and feasibility of the research. The survey data before and after the experiment were processed with SPSS 25.0 software to compare the difference in average scores between the experimental class and the control class. From there, draw conclusions about the difference between applying the experiential method in teaching Science 4 (2018) compared to traditional teaching methods.

## 2.3. Research results

### 2.3.1. Principles for organizing the teaching of Science 4 on the topics of Substance and Energy in an experiential mode

#### *a) Ensure program objectives and lesson content*

This principle requires that the design and organization of experiential teaching of Science subjects must ensure systematicity and consistency with the Science curriculum 4 (2018). This means ensuring the achievement of goals regarding general competencies, specific competencies, and qualities in the program. Teachers need to accurately and appropriately determine the goals for each experiential activity related to specific learning content to ensure appropriateness when organizing learning activities. When teaching, teachers need to focus on ensuring compliance with the specific requirements of the lesson because there can be situations where experiential activities are too attractive, leading to teachers and students deviating from the previously set teaching goals.

#### *b) Ensure suitability and maximize students' personal competences*

Teaching well means setting learning requirements and tasks so that every student in the class has the ability to perform them with the highest effort from both the intellectual and physical aspects. This principle applied in teaching in an experiential mode on the Substance and Energy topic of Science 4 (2018) is that the experiential content and implementation method must be appropriate for each specific subject; to help students develop their maximum potential.

#### *c) Ensure maximum exploitation of individual students' experience and discovery competence during the learning process*

In the process of teaching Science 4 in an experiential mode, teachers encourage students to use their senses to easily absorb experiences; students have the ability to perceive objects and phenomena from many angles; recognize different characteristics, and build relationships between them. Students learn how to apply knowledge to solve new situations well in practice. To ensure this principle, teachers need to pay attention to students' previous experiences with learning content. From there, teachers assign tasks, guide, support, and adjust appropriately when students participate in practical experiential learning activities.

#### *d) Ensure consistency between the guiding role of teachers and the proactive role of students*

Teachers need to accurately determine their own tasks and those of students to ensure that the teacher is not only an instructor but also a person who encourages and creates conditions for students to develop their positive qualities, self-discipline, and independence in the cognitive process. It is the teacher who creates trust, and motivates and encourages students to present their opinions on the issues raised when performing tasks. Teachers also need to pay attention to students' experiences so that learning tasks are not only challenging but also reflect the suitability of each student.

### 2.3.2. The process of designing teaching activities for the Substance and Energy topic in Science 4 in the experiential mode

Experiential teaching activities on the topic of Substance and the topic of Energy, Science subject 4 are based on 3 main foundations: (1) Content and requirements to be met of the topic of Substance and the topic of Energy, Science subject 4 (2018) [10]; (2) Methods, forms and types of experiences such as exploration, interactive experiments, research... are organized both inside and outside the classroom, according to the instructions of the Experiential Activities program 4 [1]; (3) David Kolb's experiential teaching model [3] with the following process:

- *Step 1.* Determine the goal of organizing teaching in an experiential way: Teachers need to clearly determine the experiential goal that students need to achieve, specifically helping students understand basic scientific concepts. That related to the topic of Substance, the topic of Energy

through direct experience, developing scientific skills such as observation, experimentation, data collection, analyzing results and solving problems, stimulating creative thinking, curiosity, and passion for the science of students, thereby raising awareness of environmental protection and efficient use of energy. Based on the identified experiential goals, teachers will plan to design lesson plans and organize appropriate experiential activities to support students in achieving the set teaching goals.

- *Step 2.* Determine the content of teaching according to the experiential method: Each lesson in the Substance and Energy topic includes content corresponding to the requirements to be met. However, not all content on the topic is suitable for organizing teaching activities in an experiential mode. Therefore, teachers need to select appropriate content to design teaching activities to ensure the effectiveness of the teaching process. Teachers can choose content about the discovery of substance and energy, properties and changes of substance, and effective use of energy to organize experiential learning. These are teaching contents that teachers can let students explore problems by using a combination of senses to perceive objects and phenomena from many angles, recognizing different characteristics of the properties of objects. substances and types of energy through visualization and experimentation. Students learn how to apply knowledge to solve new real-life situations related to environmental protection, safety, and energy saving through problem-solving, practice, and role-playing.

- *Step 3.* Design experiential learning activities for students: In this step, the process of organizing experiential learning for students is carried out in the following order:

1/ *Specific experience:* Students participate in direct observation of the objects and phenomena that they need to learn about in the Substance and Energy topics by using different senses through experimentation and investigation. Check out some other activities. From there, students have the opportunity to feel, compare analyze, and evaluate things and phenomena, linking them with personal experiences to better understand those things and phenomena.

2/ *Discover and form new knowledge:* Based on personal feelings about things and phenomena, students analyze, contrast, compare, and establish relationships between them to find their characteristics. and the basic signs and nature of that thing and phenomenon.

3/ *Practice and apply:* Students will apply newly learned knowledge about Substance and Energy topics by describing the use of that knowledge to solve real-life problems.

- *Step 4:* Design criteria and assessment tools in teaching according to the experiential method of Substance and Energy topics in Science 4 (2018).

The Science curriculum (2018) is regularly evaluated by comments, focusing on assessing students' learning process. The content of assessing students when studying the Substance and Energy topics focuses on evaluating specific abilities in the field of science. Specifically, student assessment can be done based on the following criteria:

1/ *Present basic concepts:* Assess students' ability to understand and master basic concepts under the Substance and Energy topics.

2/ *State the properties and explain the phenomena:* Assess students' ability to understand and explain the properties and phenomena related to Substance and Energy.

3/ *General capacity and personal qualities:* Assess students' general competencies and personal development, including skills and attitudes when participating in learning activities.

Subjects participating in the assessment process include students' self-assessments, students' assessments of each other, and teachers' assessments of students. The toolkit for evaluating students when learning through experiential methods on the Substance and Energy topics includes observation sheets, questionnaires, practice reports, and scales,... according to regulations on assessment levels.

### **2.3.3. Organize teaching activities on the Substance and Energy topics in Science 4 in an experiential mode**

Step 1. Set a problem and assign experiential tasks to students: Students collect experiences through reading documents, participating in lectures, and watching online videos about the lesson content in the Substance and Energy topics. Teachers exploit students' existing experiences to design and organize warm-up activities to stimulate interest and guide students into lesson content. In the Substance and Energy topics, experiential learning activities need to be designed to make the most of the knowledge related to Substance and Energy that students have previously collected.

Step 2. Students perform the problem-solving task: Students analyze and combine existing experiences about the content they have learned in Substance and Energy topics to evaluate rationality and logic and consider whether there are any views that contradict their own experience. In the process of naturally reflecting and recording those thoughts, students will draw new lessons and directions to make their next learning journey more interesting and effective. In this step, students can perform experiments or projects, then discuss and share with friends to eliminate previous mistakes or shortcomings. During the teaching process, teachers will evaluate the results of students' experiences and give comments and suggestions as well as use creative teaching techniques appropriate to the topic to be more effective.

Step 3. Organize students to form new concepts: After conducting detailed observation and deep reflection on the learning content in the topic, students begin the process of conceptualizing the experiences they have collected. From these experiences, new concepts and theories related to the lesson content in the Substance and Energy topics will be formed. Teachers can suggest questions to students and guide students in organizing collaborative activities and connecting ideas to create opportunities for students to discuss and thereby draw conclusions. Then students continue to conceptualize the experiences they have had, perfect concepts, and build new knowledge according to the lesson content in the topic. This stage plays an important role because it helps convert experiences into knowledge, a conceptual system that students retain in their thinking. This can be considered the concluding step of the entire thinking process, evaluating the accuracy of the conclusions that students have made.

Step 4. Organize students to experiment in new situations: Students have created a conclusion based on reality, using arguments and thinking closely about the content they have learned. This conclusion can be considered as a hypothesis that needs to be tested in practice, which is an important process in building practical knowledge. At this stage, students perform practice exercises on the Substance and Energy topics, apply knowledge, and solve real-life situations organized by teachers related to these aspects. “substance” and “energy” in everyday life. After applying and testing in practice, students have the opportunity to adjust and supplement current experiences, and accumulate new experiences and knowledge about content related to “substance” and “energy”, creating the next cycle in the “experiential learning” process.

### **2.3.4. Design lesson plans based on experiential mode**

In this research, 03 lesson plans were designed in experience mode including Pollution and protection of water resources; Sound; Heat transfer, and thermal conductors. The lesson plans are designed according to the given principles and procedures for designing teaching activities. Each lesson plan is designed to teach 2 periods. Teaching activities in each lesson are carried out according to procedures to ensure experience but still follow the instructions for building lesson plans in Science (2018) according to Official Dispatch 2345 of the Ministry of Education and Training the following:

- Warm-up activities: Teachers create excitement and curiosity for students about the content in the lessons on the “Substance” and “Energy” topics by using diverse activities such as

organizing games, Open-ended questions, illustrations, videos, or songs related to these topics to attract student's attention to the lesson.

- **Discovery activities:** Teachers provide situations, problems, or experiments about the lesson content in Substance and Energy topics for students to explore and learn for themselves. Students are instructed to work in groups or independently to find solutions to problems, using a variety of learning materials such as experiments and simulations to support the discovery process.

- **Practice activities:** Teachers create situations directly related to the lesson content on the Substance and Energy topics, then help students apply knowledge to real-life situations. By using learning aids and teaching techniques, teachers create a positive and creative environment, encouraging the active participation of all students.

- **Application activities:** Teachers create practical situations related to the content they have learned about the Substance and Energy topics to encourage students to apply their knowledge and skills to solve problems. Students work in groups or independently to find solutions to problems and receive feedback to improve their skills and understanding of the knowledge they have learned on this topic.

### **2.3.5. Pedagogical experience**

Research conducted educational experiments on experiential teaching activities of 3 lessons in Fourth Grade Science (2018), specifically: Lesson 3: Pollution and protection of water resources; Lesson 10: Sound and Lesson 13: Heat transfer and thermal conductors.

Participants: including 2 fourth grades of Nguyen Thai Son Primary School, District 3, Ho Chi Minh City. The experimental class has 46 students who will teach in an experiential way of Science in 3 designed lessons on Substance and Energy.

The control class had 45 students teaching 3 Science lessons not by experiential method but by conventional teaching method. Evaluation criteria for 3 experimental lessons are built based on the requirements of the Fourth Grade Science subject.

The content and method of assessment are carried out as follows: Using a test designed on a 10-point scale to evaluate scientific capacity before the experiment and after the experiment. In which, sentences 1 to 4 evaluate the natural science cognitive competence, sentences 5 to 7 evaluate the ability to learn about the surrounding natural environment, and sentences 8 and 9 evaluate the competence to apply knowledge and skills according to the requirements of the topic.

**Table 1. Results of pre-test scores of the experimental class and control class**

Score	5	6	7	8	9	10	Total	Medium score
Experimental class	7 (10.9%)	19 (37%)	6 (17.4%)	9 (24%)	5 (10.9%)	0 (0%)	46	6.7
Control class	7 (15.6%)	15 (33.3%)	13 (28.9%)	4 (8.9%)	6 (8.9%)	0 (4.4%)	45	6.72

The test results in Table 1 show that students in both the experimental class and the control class achieved similar scores, so they were quite similar in academic ability. In particular, the high average scores (6.7 and 6.72) show that students have knowledge and experience about learning content related to the learning content in the illustrated lesson plans. After the experiment, the research used test questions to evaluate the specific competences formed by students. Detailed results are in Table 2.

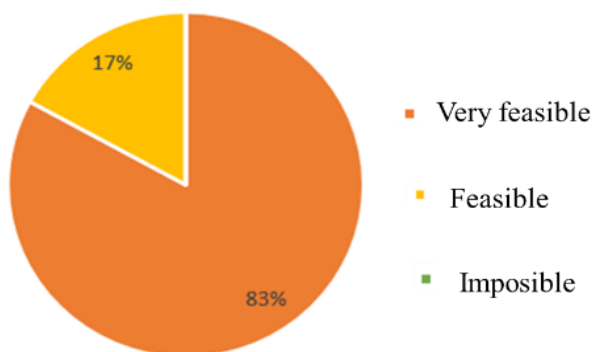
Thus, after the process of implementing experiential teaching, the three lesson plans designed showed that: in the experimental class the average score on the test was 8.35, while in the control class, the average score was 7.33. about 1 point lower.

**Table 2. Results of test scores after the experiment of the experimental class and control class**

Score	5	6	7	8	9	10	Total	Medium score
Experimental class	2 (4.3%)	3 (6.5%)	8 (17.4%)	7 (15.2%)	16 (34.9%)	10 (21.7%)	46	8.35
Control class	4 (8.9)	9 (20%)	12 (26.7%)	11 (24.4%)	6 (13.3%)	3 (6.7%)	45	7.33

In the experimental class: the number of post-experiment tests from 9 points (16 tests) to 10 points (10 tests) increased much more than before the experiment: 5 tests scored 9 and 0 tests scored 10. Many students before the experiment only reached the completion level, while after the experiment they reached a good level of completion. Meanwhile, in the control class, the total number of students scoring 9 (13.3%) and 10 (6.7%) was only about half that of the experimental class. At the same time, the number of tests from points 5 to 8 in the experimental class was lower than in the control class. This result shows that when teaching the three lesson plans of the topic Substance and Energy in Science 4 in an experiential mode, there has been a significant improvement in the science competency components which formed in students according to the requirements to be achieved compared to teaching activities not implemented according to this teaching mode. On the other hand, when observing the experimental class and the control class, it also shows that: 100% of the students in the experimental class like to participate in learning activities. The reasons given by students to explain this choice are “the lesson is fun and interesting”, “I can exchange and share my opinions with other students”,... Thus, teaching according to the experiential mode, in addition to developing students' abilities, also helps students actively participate, be autonomous and creative. This is the condition to form and comprehensively develop students' competences and qualities.

The research also conducted a survey of 2 administrators and 10 teachers at Nguyen Thai Son Primary School about the feasibility of organizing lessons according to the designed experiential mode. The results of the survey are shown in Figure 1.



**Figure 1. Feasibility of organizing lessons of the topics of Substance and Energy in Science subject 4 according to the experience mode**

The results in Figure 1 show that 100% of teachers and administrators surveyed agreed that organizing lessons according to the experiential mode is feasible and very feasible. Of these, 83% (10/12 teachers) think that organizing teaching according to the experiential mode is very feasible. Based on the above results, it can be concluded that organizing teaching and learning lessons in an experiential mode, as described in the topic, is very suitable and can be successfully implemented in primary schools.



### **3. Conclusions**

The research has developed four principles when organizing teaching in an experiential way on the topics of Substance and Energy in Science subject 4. At the same time, the research has proposed a process for designing lessons in an experiential way and experimentally implementing the feasibility and initial effectiveness of these lessons in real-life environments through three lessons: “Water pollution and protection,” “Sound,” and “Heat transfer and thermal conductors”. The experimental results showed that the test results of students in the experimental class were better than those of students in the control class. Therefore, it can be concluded that the teaching activities and teaching processes on the Substance and Energy topics in Science 4 (2018) in an experiential mode are feasible and can be implemented effectively in primary schools.

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