

# APPLICATION OF STATION ROTATION APPROACH IN TEACHING SCIENCE TO DEVELOP NATURAL SCIENCE COMPETENCIES FOR PRIMARY SCHOOL STUDENTS

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**Abstract:** *According to the 2018 General Education Curriculum, the Grade 4 Science subject aims to develop student competencies, with natural science competency being a specific competency of this subject. Station rotation (learning by station) is an instructional approach in which students carry out learning tasks at different stations or locations within the classroom. Students will master different learning content at each station, and after rotating through the stations, they will have completed the learning tasks. Each station essentially represents a learning task with accompanying materials and resources. This paper analyzes the concept and role of station-based teaching, and proposes a process for applying station-based teaching in Grade 4 Science instruction to develop students' natural science competencies. The process includes the following steps: 1/ Identify the required natural science competencies and learning tasks, 2/Prepare the supporting materials and resources for each station, 3/Assign learning tasks, and guide students' station-based learning activities, 4/ Students work at the various stations, 5/ Evaluate and summarize the learning activities. The research also provides specific examples of applying the station-based approach in Grade 4 Science instruction to develop primary school students' natural science competencies.*

**Keywords:** *Natural science competencies Station rotation approach, Grade 4 science, Primary school students.*

## 1. INTRODUCTION

Teaching science education faces significant shifts in curriculum design and instructional approaches amidst the challenges of globalization and the diversification of educational contexts (Rogayan, 2019). Rogayan (2019) asserted that the utilization of station-based teaching methods constitutes an effective strategy for enhancing academic achievement and attitudes towards science.

Yasin et al. (2014) utilized station-based teaching within special education programs for students with disabilities. This instructional method creates opportunities for experiential learning and is implemented according to individual abilities and preferences, enhancing student interest and mastery of behavioral skills (Yasin *et al.*, 2014). Research by Fox (2004) and Ocak (2010) affirms that learning stations enable students to engage in active, participatory learning. Simultaneously, teachers manage the instructional materials and

facilitate student agency, as learners can select the topics, approaches, and pacing of their work.

In Vietnam, authors Nguyen Van Bien, Nguyen Thi Thu Thuy (2011) and Phung Viet Hai, et al. (2013) have investigated the application of station-based teaching in Physics education to stimulate student interest and engagement, creating an active and enjoyable learning environment to enhance the quality of teaching and learning.

Prior research has predominantly focused on the implementation of station-based instructional approaches across diverse academic disciplines. However, there remains a paucity of empirical investigations examining the application of this pedagogical method specifically within the context of primary-level science education. This represents a notable gap in the extant literature, particularly given the recent curricular reforms in general education that emphasize the development of student competencies, including those pertaining to the natural sciences.

Therefore, researching the steps for applying station-based teaching in science education with the aim of developing scientific competencies for primary school students will be a highly meaningful line of inquiry. This will help provide specific guidance for teachers in organizing station-based instruction, thereby creating an active and engaging learning environment, and ultimately contributing to the enhancement of the quality of science teaching and learning at the primary level.

## **2. METHOD**

The main research method used in this study is the theoretical research method. Using this method, we examined research related to the research problem, including natural science competence, the elementary school Science curriculum, and station-based teaching. Based on the analysis and inheritance of previous researchers' achievements, we conducted document analysis to discover and explore the different aspects of the collected information. We then organized the information about the research problem into a structured system to build a theory on the process of applying station-based teaching to develop natural science competence for elementary school students. At the same time, we provided an example to illustrate the application of station-based teaching to develop science competence for elementary school students in Science lessons.

## **3. RESULTS AND DISCUSSION**

### **3.1. Natural science competencies in the Science subject at the primary school**

Weiner (2001) posited that competence encompasses the learned or innate abilities and skills of an individual that enable them to effectively address specific situations, as well as the motivational, social, and applied problem-solving readiness to responsibly and efficiently utilize these capabilities in flexible contexts (Meier & Nguyen, 2014). The 2018 General Education Curriculum in Vietnam defines competence as an individual attribute that is formed and developed through innate qualities and the process of learning and

training. This allows an individual to mobilize an integrated set of knowledge, skills, and other personal attributes such as interests, beliefs, and willpower to successfully execute a particular activity and achieve desired outcomes under specific conditions (MOET, 2018a).

The Science subject in Grade 4 contributes to the formation and development of students' love for humanity and nature; scientific imagination; interest in exploring the natural world; awareness of protecting their own, their family's, and the community's health; awareness of saving and protecting natural resources; and a sense of responsibility towards their living environment (MOET, 2018b). The subject also helps shape and develop students' competencies in self-direction and self-learning, communication and collaboration, problem-solving, and creativity. Specifically, the Science subject contributes to the formation and development of students' natural science competencies, including: Understanding natural science concepts; Investigating the surrounding natural environment; Applying the knowledge and skills they have learned (MOET, 2018b).

+ Understanding of Natural Science: Identify, recognize, and describe simple natural phenomena and objects in nature and everyday life; Explain the basic properties of simple natural phenomena and objects; Communicate observations and explanations using various representations like language, diagrams, charts, etc; Compare, select, and classify natural phenomena and objects based on certain criteria; Explain the relationships between different natural phenomena and objects.

+ Investigating the surrounding Natural Environment: Observe natural phenomena and objects, and formulate questions about them; Make predictions about natural phenomena, objects, and their relationships; Propose ways to test their predictions; Collect information about natural phenomena, objects, and their relationships; Use simple tools to observe, experiment, and record data; Draw inferences, make conclusions about the characteristics and relationships of natural phenomena and objects based on observations and experiments.

+ Applying Knowledge and Skills: Explain some natural phenomena, objects, and their relationships; Apply scientific knowledge and skills from other relevant subjects; Analyze situations, propose appropriate responses, and encourage others to take action in certain situations; Reflect on and evaluate problem-solving approaches and responses in real-life situations.

### **3.2. The concept and role of station-based learning**

Ocak (2010) stated that learning stations is one of the new teaching methods, which are appropriate ways for the social and intellectual level of the construction of knowledge. In addition, Wright (2015) mentioned that Learning station method is an important method in reforming education; it helps children increase their learning time as well as receive more supports so that they will improve their competencies and get better learning achievement.

According to Nguyen Van Bien and Nguyen Thi Thu Thuy (2011), the Learning Station (Lernstationen or Learning Station or Circuit training) is an instructional method in which

students independently and actively carry out different learning tasks in a sequential manner at designated locations within or outside the classroom environment.

The Learning Station approach is a student-centered instructional method (Ocak, 2010). During the learning process at the stations, individual students, pairs, or small groups must independently explore and solve the learning tasks at each station. As a result, students become autonomous and actively engaged in addressing the learning tasks. This approach provides students with opportunities to enhance their teamwork skills, argumentation abilities, and problem-solving methods.

The learning tasks, especially those involving simple design, construction, and experimentation activities, can significantly increase students' motivation and interest. Furthermore, the Learning Station method allows teachers to differentiate instruction based on learners' levels, capabilities, and learning styles, thereby facilitating the comprehensive and holistic development of students (Pham Viet Quynh, 2019).

However, when teaching using the learning station approach, it is also necessary to pay attention to the time required to teach a unit of knowledge using this teaching method, which is usually longer than the time when teaching in a traditional format. Teaching using learning stations is not suitable for classes with large numbers of students, as the teacher will find it very difficult to oversee the entire class. It demands that the teacher has extensive and in-depth knowledge as well as excellent communication skills. Teachers will face many difficulties if their specialized knowledge is limited and they have little experience in organizing group activities (Pham Viet Quynh, 2019).

### **3.3. The station-based learning process in Science subject to develop natural science competencies for primary school students**

#### **3.3.1. The Process**

*- Step 1: Identify the required science competencies and learning tasks*

Based on the content of the lesson, determine the required natural science competencies to be developed in teaching the Science subject in primary schools. For example, in the topic of Fungi, the required competencies associated with the elements of natural science competence are as follows: 1/Awareness of natural science: Recognize that fungi have diverse shapes, sizes, colors, and habitats through observing pictures and/or videos; State the names and some characteristics (shape, color) of edible fungi through observing pictures and/or videos; Identify the harmful effects of some mold fungi that spoil food, through experiments or by observing pictures and videos; 2/Exploring the natural environment: Discover the benefits of some yeasts in food processing (e.g., making bread) through hands-on experiments or by observing pictures and videos; Draw a diagram (or use a provided diagram) and label the parts of a fungus; 3/ Applying knowledge and skills: Apply knowledge about the causes of food spoilage and state some food preservation methods (refrigeration, drying, salting, etc.); Apply the knowledge learned to identify poisonous fungi and prevent food poisoning.

Based on the content and the required natural science competencies, the teacher will determine the number of stations and the learning tasks. The number of stations depends on the content that the teacher organizes for the corresponding teaching and learning activities. The learning tasks at each station should be relatively independent of each other, so that students can start from any station. After completing a station, the students can move on to any of the remaining stations. Additionally, the learning stations can also be organized in a circular fashion

*- Step 2: Prepare support materials for each station*

Learning stations can be organized with differentiation in the level of specific, detailed, or general guidance through a system of support cards. At each station, the teacher will design a learning activity card for the station and instructions for the students. At the same time, students will receive a summary card to guide them in completing the learning cycles. Based on the summary activity card, the teacher can monitor the students' activity process.

*- Step 3: Assign learning tasks and guide learning activities at the stations*

The teacher introduces the learning content at the stations, the number of stations, the learning activity cards, and the important notes to keep in mind when carrying out the tasks at the stations. At the same time, it is necessary to establish learning station rules for students to follow. Students can form their own groups based on interests, abilities, and learning styles, or the teacher can assign groups to facilitate the learning process and avoid wasting too much time.

*- Step 4: Carry out the learning tasks at the stations*

Students will follow the learning cycle that the teacher has initially established and move to the next station to complete the next task. Students can work individually or in groups depending on the requirements of the learning tasks at each station. The teacher needs to encourage students to actively learn at the stations and provide assistance when students encounter difficulties.

*- Step 5: Evaluate and summarize the learning activities*

Students will select representatives to present the results at each station, drawing their own conclusions from the activities, and other groups will provide comments and additional inputs. After that, the teacher will evaluate the task completion results of each group at each station, based on an assessment of the group's engagement and the quality of their task performance.

### **3.3.2 Example Illustration**

Exploration Activity 1 on Obesity in Lesson 25 "Some Diseases Related to Nutrition" from the 4<sup>th</sup> grade Science textbook "Connecting Knowledge with Life":

*Step 1: Identify the required science competencies and learning tasks*

Requirements for natural science competence: (i) Understanding of natural science: Identify the signs of obesity through observation of real situations, pictures, or videos.

Explain the causes of obesity; (ii) Exploring the natural environment: Investigate daily habits, diet, and physical activities, and identify some of the causes of obesity;

(iii) Applying the knowledge and skills learned: Engage in activities to prevent obesity. Promote awareness about obesity prevention measures to friends and family.

- Station 1: Symptoms of Obesity. Required Competency: Identify the main symptoms of obesity; Learning Task: Specified in Worksheet 1.

- Station 2: Causes of Obesity. Required Competency: Explain some of the causes of obesity. Learning Task: Specified in Worksheet 2.

- Station 3: Obesity Prevention. Required Competency: Identify ways to prevent obesity. Learning Task: Specified in Worksheet 3.

- Station 4: Healthy Together. Required Competency: Share with others the exercise habits to prevent obesity. Learning Task: Specified in Worksheet 4.

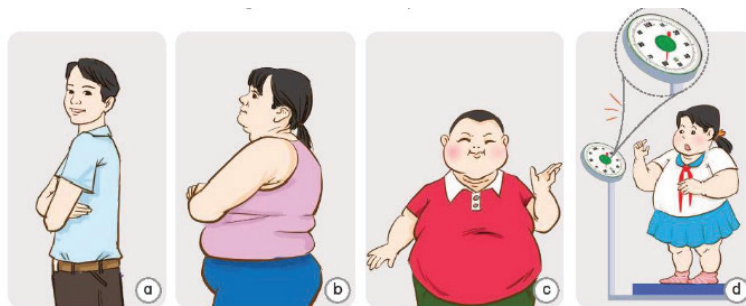
*Step 2: Prepare support materials for each station*

Station 1: Symptoms of Obesity

**Worksheet 1**

Name: \_\_\_\_\_ Group: \_\_\_\_\_ Class: \_\_\_\_\_

Task: Observe Figure 1 (source: 4<sup>th</sup> grade Science textbook “Connecting Knowledge with Life”)



Hình 1

- Which image depicts an overweight or obese person? Why?

.....

- List the signs or symptoms of an overweight or obese person?

.....

.....

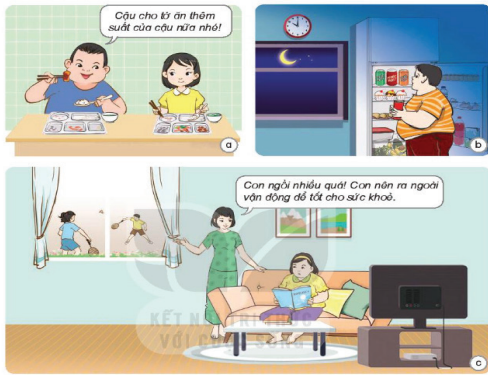


Station 2: Causes of Obesity

**Worksheet 2**

Name: \_\_\_\_\_ Group: \_\_\_\_\_ Class: \_\_\_\_\_

Task: Observe Figure 2 (source: 4<sup>th</sup> grade Science textbook “Connecting Knowledge with Life”)



Hình 2

What eating, exercise, and lifestyle habits can lead to overweight and obesity?

.....  
 .....  
 .....

What are the main causes that can lead to overweight and obesity?

.....

Station 3: Obesity Prevention

**Worksheet 3**

Name: \_\_\_\_\_ Group: \_\_\_\_\_ Class: \_\_\_\_\_

**Task:**

- List the activities you do in a typical day.

Name	Physical Activities

- What activities from the list above can help prevent overweight and obesity?

.....

- What do I need to do to prevent overweight and obesity?

.....

Station 4: Healthy Together

**Worksheet 4**

Name: \_\_\_\_\_ Group: \_\_\_\_\_ Class: \_\_\_\_\_

**Task:**

- Share with your friend some eating and physical activity habits that need to be changed in order to prevent obesity.

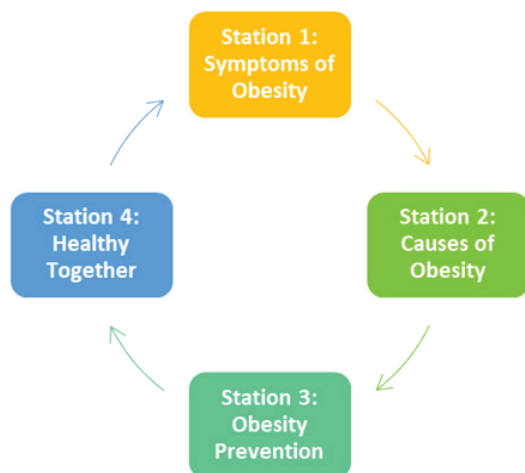
.....  
 .....

- Let's create a promotional poster together about measures to prevent obesity. Afterwards, each group will display their posters.

- *Step 3: Assign learning tasks and guide learning activities at the stations:* The teacher introduces the content and requirements at the various stations: there are 4 stations with corresponding learning task sheets. Students research the content and requirements at each station, then carry out the tasks assigned at each station.

- *Step 4: Carry out the learning tasks at the stations*

Students carry out station-based learning according to the following diagram:



**Figure 1. Diagram of the Learning Stations**

Students with the same task choices are grouped together. Students carry out the tasks at the various learning stations. After completing the tasks at the stations, students gather in groups with those who chose the same tasks to discuss and reach a consensus. The teacher provides support and assistance to the students as they carry out their tasks.

- *Step 5: Evaluate and summarize the learning activities*

The teacher organizes reporting and feedback. Representatives from each group report on the results of completing each task at the various stations. Students provide peer reviews and evaluations, and draw conclusions.

Conclusion: Overweight and obese individuals have a body weight to height ratio greater than the healthy standard range for their age group. The patient's body has excessive fat layers accumulated in certain areas like under the arms, abdomen, waist, chin, etc. The typical causes are an imbalanced diet high in carbohydrates, fats, proteins, and lack of physical activity.

### 3.4. Pedagogical Experiment

The participants in the pedagogical experiment were 181 students, including 96 students from Dai Kim Primary School (47 students in class 4A2, 49 students in class 4A5) and 95 students from Hoang Mai Primary School (47 students in class 4A1 and 48 students in class 4A3). Among them, the control group (4A1 and 4A2) had a total of 94 students, and the experimental group (4A5 and 4A3) had a total of 97 students. The academic performance of the two classes in the first semester of the 2023-2024 school year was equivalent. The pedagogical experiment was conducted over 4 weeks from February 14, 2024 to March 13, 2024.



Assessment of the level of achievement of natural science competence, using written tests (a combination of subjective and objective assessment). The data was analyzed and processed using Excel software. Conclusions about the results of the experiment were based on mathematical analysis and statistics. The level of achievement of natural science competence was evaluated according to the following levels (table 1)

**Table 1. Criteria for achieving natural science competence (in learning activities about obesity)**

Level	Criteria for achieving natural science competence (in learning activities about obesity)
Level 1 (not yet completed): < 5 points	Natural science awareness: Unable to fully state the symptoms of obesity through observation of real situations, pictures or videos; Unable to state the causes of obesity.
Level 2 (completed): from 5 points to 6 points	Natural science awareness: Able to fully state the symptoms of obesity through observation of real situations, pictures or videos; Able to state the causes of obesity.
Level 3 (Well Completed) from 7 points to 8 points	Exploring the natural environment around: Able to name at least 3 daily habits, eating and exercising that can lead to obesity; Able to identify at least 3 causes of obesity.
Level 4 (Excellent Completed): from 9 points to 10 points	Application of the knowledge and skills learned: Able to perform 3 activities to prevent obesity for themselves in their daily life; Able to promote to friends and family about measures to prevent obesity

Results of the tests assessing the natural science competence of students after the pedagogical experiment on station-based teaching for the control class and the experimental class are shown in Figure 2:

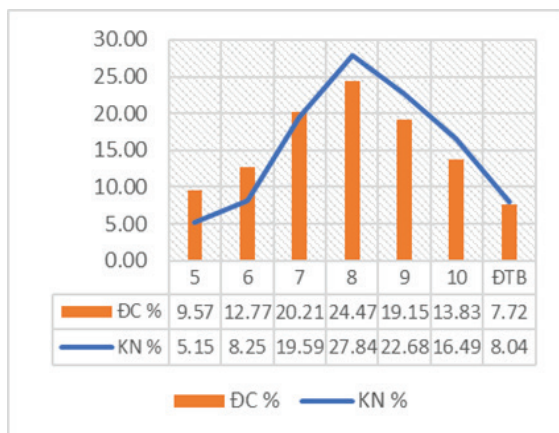


Figure 2a

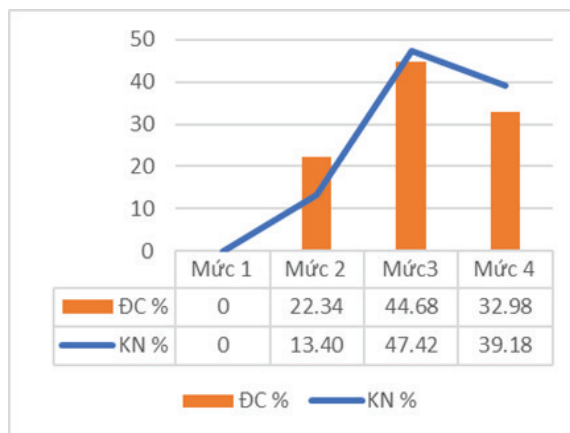


Figure 2b

**Figure 2. Experimental results of the experimental class (KN) and the control class (ĐC) (Note - ĐTB - average score)**

Figure 2a, it can be seen that after the implementation of the experimental intervention, the graph of scores from 5 to 7 points of the control class is always higher than the experimental class, while the graph of scores from 8 to 10 points of the experimental class is always higher than the control class. At the same time, the average score of the experimental class is higher than the control class (8.04 > 7.72).

Figure 2b shows the results of the assessment of the students' level of achievement in natural science competence: at levels 1 & 2, the graph of the control class is higher than the experimental class, while at levels 3 & 4, the graph of the experimental class is higher than the control class. This proves that after the intervention of the station-based teaching process proposed in the teaching of Science 4, the learning outcomes of the experimental class have been significantly improved. Thus, the experiment on the impact of the station-based teaching process in the teaching of Science 4 on the experimental class is meaningful, and the natural science competence of the students has been improved. This initial result can confirm that the process of applying station-based teaching is feasible and contributes to improving the natural science competence of students in elementary school Science teaching. In the following studies, further and wider experiments will be conducted to better evaluate the effectiveness of this station-based teaching process.

#### 4. CONCLUSION

Teaching using the learning station approach is a student-centered teaching method that aims to develop students' capabilities. Based on an analysis of the scientific competencies in the primary science curriculum, this research has analyzed the steps for applying the learning station approach in teaching this subject. The process and illustrative examples provided above help teachers plan appropriate learning station-based lessons, thereby contributing to the development of general competencies and, in particular, scientific competence for students in primary science teaching. In the following studies, we will refine and organize pedagogical experiments to reach more comprehensive and complete conclusions.

#### REFERENCES

1. Bernd Meier, Nguyen Van Cuong (2014). *Modern Teaching Theory - Basis for Renewing Teaching Objectives, Content and Methods*. Pedagogy University Publishing House, pp. 66-72
2. Breckler, Jennifer and Amin Azzam (2011). The Basic Science Learning Station: An Innovative Kinesthetic Learning Approach in one Medical School. *San Francisco: University of California*. Retrieved March 2, 2016 from <http://www.iamse.org/mse-article/the-basic-science-learning-station-an-innovativekinesthetic-learning-approach-in-one-medical-school/>
3. Ministry of Education and Training (2018a). *General Education Curriculum - Comprehensive Curriculum*. Issued together with Circular No. 32/2018/TT-BGDĐT dated December 26, 2018 of the Minister of Education and Training.
4. Ministry of Education and Training (2018). *General Education Curriculum for the Subject of Science*, Issued together with Circular No. 32/2018/TT-BGDĐT dated December 26, 2018 of the Minister of Education and Training.
5. Fox, J. (2004). Rotate, differentiate, and motivate: how a blend of learning stations and the multiple intelligences theory can boost motivation and enhance learning in the middle school classroom. Retrieved April, 5, 2016.
6. Nguyen Van Bien, Nguyen Thi Thu Thuy (2011). Station-Based Teaching of Some Knowledge about the Greenhouse Effect and the Results Obtained. *Journal of Education*, Special Issue, pp. 32-34.
7. Ocak, G. (2010). The Effect of Learning Stations on the Level of Academic Success and Retention of Elementary School Students. *New Educational Review*, 21(2).

8. Pham Viet Quynh (2019). Approach to Differentiated Instruction in the Elementary School Child Physiology Course for Primary Education Students. *Doctoral Dissertation*. Hanoi Pedagogical University.
9. Phung Viet Hai, Phung Thi To Loan, and Le Thi Dieu (2013). Application of Station-Based Teaching Method in Teaching the Gas Substances Chapter in 10th Grade Physics, *Journal of Science*, An Giang University, No. 01, pp.84 - 90.
10. Rogayan Jr, D. V. (2019). Biology Learning Station Strategy (BLISS): Its Effects on Science Achievement and Attitude towards Biology. *International Journal on Social and Education Sciences*, 1(2), pp.78-89.
11. Yasin, M.H., Toran H., Tahar M.M., Tahir, L., and Suriawati, N. (2014). Learning Station Method in Special Education Programs for Students with Learning Disabilities. *Pertanika Journal of Social Science & Humanities* 22 (3): pp.717 – 728. Retrieved from <http://www.pertanika.upm.edu.my/>.